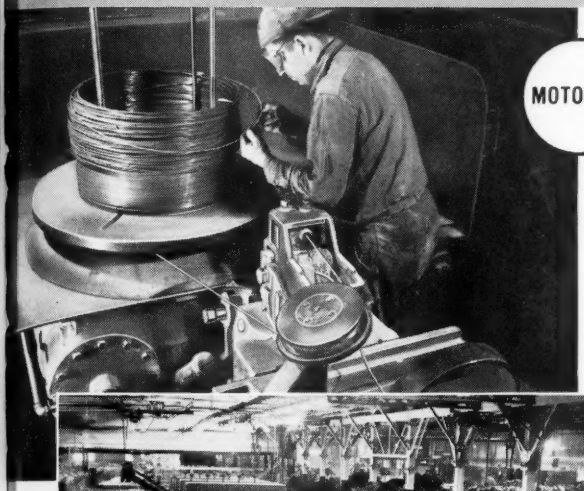
WIRE AND WIRE PRODUCTS

APRIL 1950



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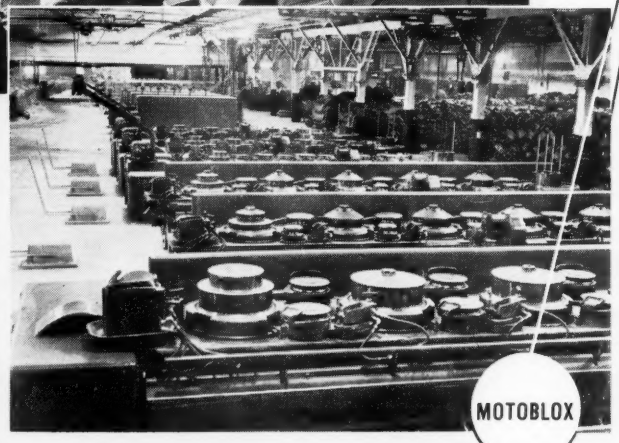

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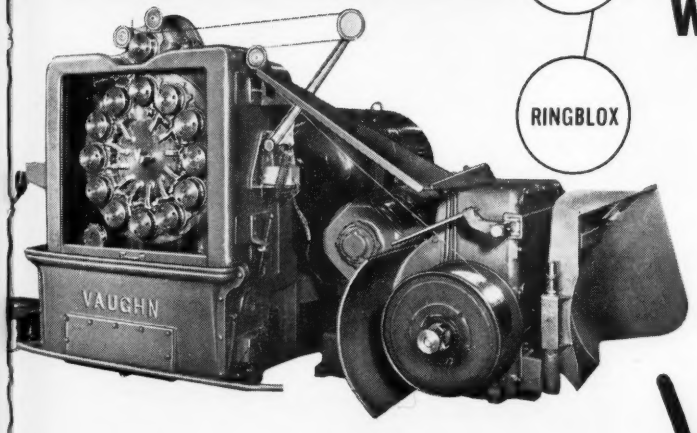


RINGBLOX

WIRE FOR THE NEEDS OF Millions...

EFFICIENTLY and ECONOMICALLY PRODUCED by

Vaughn

WIRE DRAWING MACHINERY

From fence to fish-hooks . . . up, down, across and around the country . . . wire serves everyone in thousands of ways. Volume consumption calls for volume production—VAUGHN production—and with profit assured by Vaughn efficiency and economy in operation. *Write!*

Vaughn, Motobloc, Motoblox—Registered U.S. Patent Office

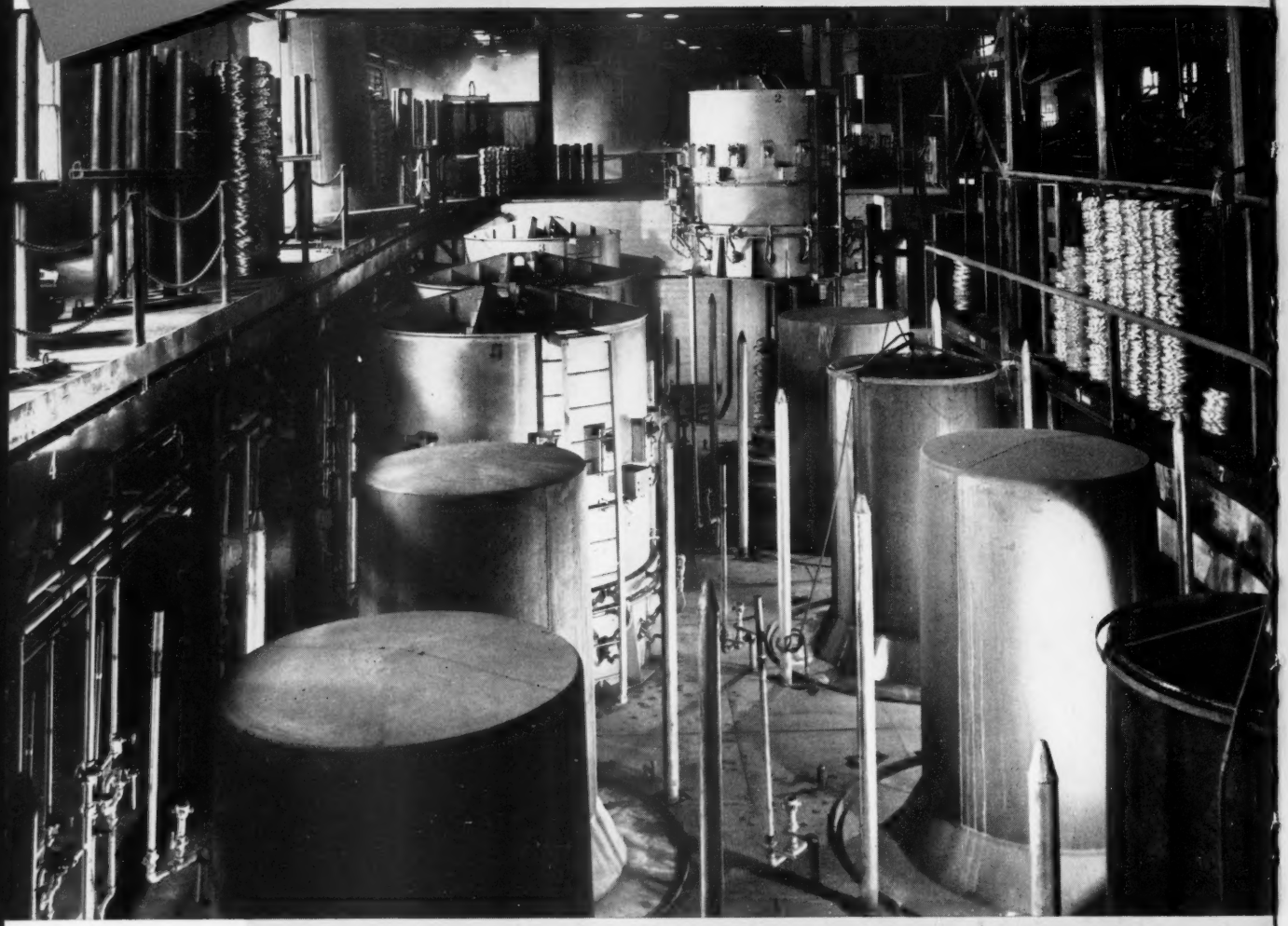
The VAUGHN MACHINERY CO.
Cuyahoga Falls, Ohio, U.S.A.

COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

Lee Wilson

WIRE Annealing



This photograph shows an installation of 5 Wilson Wire Annealing furnaces and 14 bases in one of the plants of a very large producer of fine wire completed for operation in late 1949. This excellent layout of equipment reflects the engineering skill and experience of an organization which has installed a vast majority of the wire annealing equipment in the wire mills in the U. S. and Canada and is contributing with this equipment to the industrial expansion of the countries in the European Recovery Plan.

ENGINEERED AND CONSTRUCTED BY THE

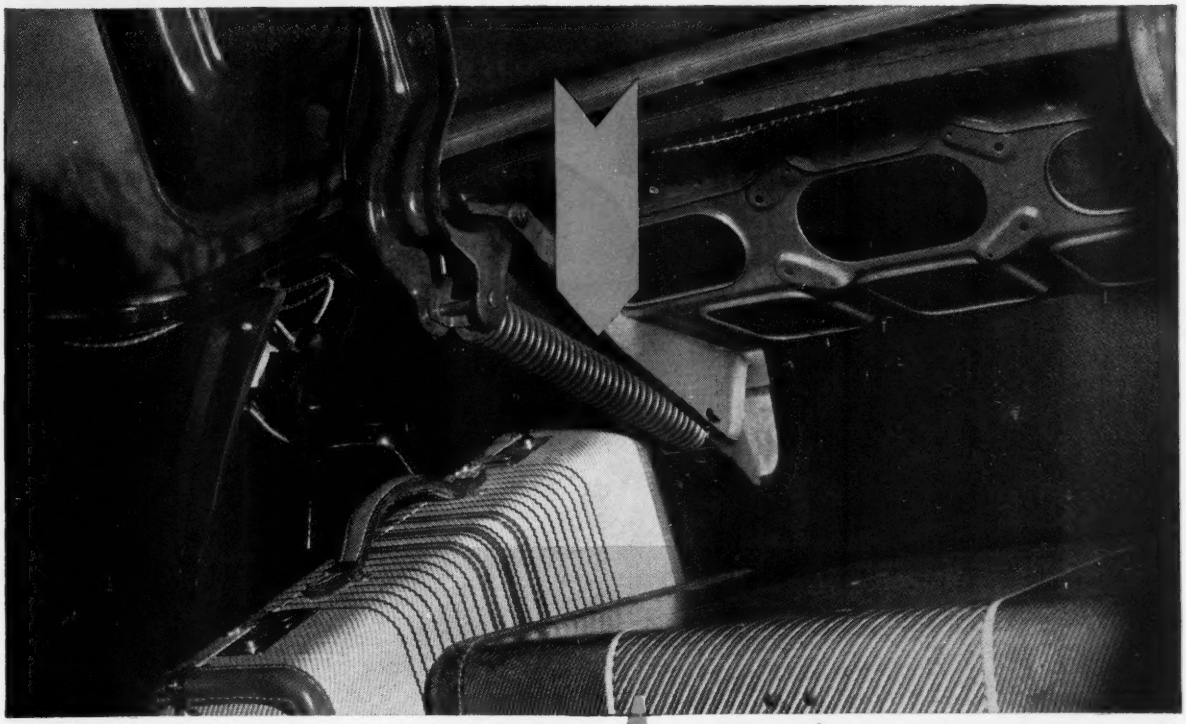
LEE WILSON ENGINEERING *Company, Inc.*

20005 West Lake Road CLEVELAND, OHIO

Telephone ACademy 4670

INDUSTRIAL FURNACES • RADIANT TUBE HEATING • HEAT TREATING PROCESSES

This spring has to *STRETCH*—



so it's made from Amertemp oil tempered wire

● This automobile trunk lid spring has to have plenty of stretch . . . has to exert a strong, even pull *despite* the high deflection.

So the manufacturer made his springs from U·S·S Amertemp—oil tempered wire.

Amertemp has a high elastic limit — can be subjected to much higher stresses than hard drawn or rolled material. Thus, springs made from this quality wire can give top, long-life service under some of the most brutal operating conditions.

Production men, too, appreciate Amertemp every bit as much as designers. Because Amertemp is uniform, and as free from defects as precision manufacturing methods can make it. Severe quality control is the reason for this uniformity . . . a basic requirement, if high-speed, *low-cost* fabricating methods are to be used. And you can be sure of this: When you reorder—in a month or in a year—you'll get the *same* wire, with the *same* physical properties that you got in *every* previous order.

If you have a tough wire problem, and can't afford mistakes, use the down-to-earth experience of our engineers. You are not obligated in any way. Just call or write the nearest American Steel & Wire Company office.

If you use oil tempered wire use — U·S·S Amertemp!

USS

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
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UNITED STATES STEEL

Pure Zinc is locked on

BETHANIZED WIRE

Zinc armor that stays put . . . that's bethanized wire. Whether you bend it, twist it, wrap it — even draw it — the zinc won't crack or peel off. The exceptional ductility of this protective zinc jacket makes it ideal for uses where severe forming must be performed. And bethanized wire is tops when you need stubborn resistance to corrosion.

New users are always amazed by the uniformity of the coating, the perfect bond between 99.9-pct-pure zinc and steel. Our highly-developed electrolytic process deposits pure zinc atom by atom on the steel wire, locking on this bright finish so smoothly, so tightly.

Bethanized wire may be the answer to one of your wire problems . . . whether you need hard- or soft-temper wire, standard or extra-heavy coating weights. We suggest you get complete details from one of our wire specialists. The nearest Bethlehem sales office will give your request prompt attention.

SOME TYPICAL USES OF BETHANIZED WIRE:

Coil springs
Telephone wire Barbed wire
Solid clothes line
Twisted wire brushes
Coat hanger hooks
Wheel spokes
Cotter pins Chain-link fence
Core for aluminum conductor (A.C.S.R.)
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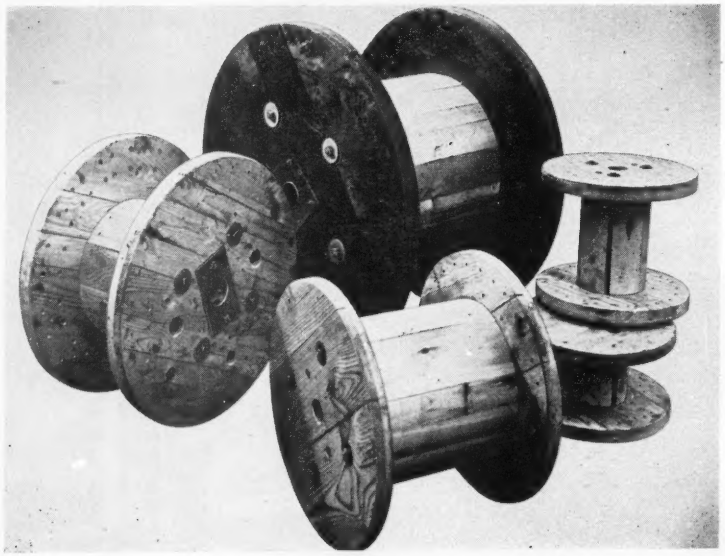
WIRE & WIRE PRODUCTS, Vol. 25, No. 4, April, 1950. Publication Office, at One Sherman Ave., Jersey City 7, N. J. Executive Office 300 Main Street, Stamford, Conn. Published monthly by the Quinn-Brown Publishing Corp., Richard E. Brown, President; R. S. Spengel, Secy. and Treas. Subscription price: U S. $5.00; Canada, $5.00 per year; 50 cents per copy; Foreign, $7.50 per year. Entered as second class matter, January 10, 1949, at the Post Office, Jersey City, N. J., under Act of March 3, 1879.

REELS MADE OF WOOD

RETURNABLE AND NON-RETURNABLE



BRIDGE SHIPPING and SHOPREELS are furnished assembled or knocked-down, made to your specifications. Built to withstand severest handling. Sturdy, strong, low in cost. For

CABLE,
ROPE
and WIRE

Sizes: 12" to 96" in diameter. Also, Reel Heads for Steel Drums.

BRIDGE streamlined production methods give you reels of the finest possible construction at the cost of ordinary reels. You are cordially invited to visit our plant to see how your reels are made.

BUT, BESIDES GOOD REELS, BRIDGE GIVES YOU EXCEPTIONAL SERVICE

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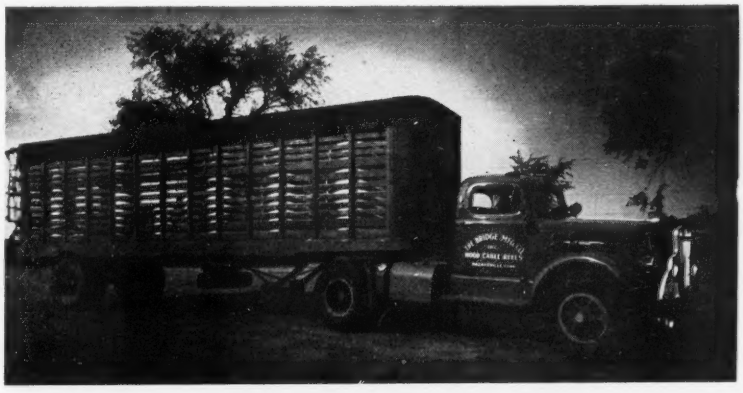

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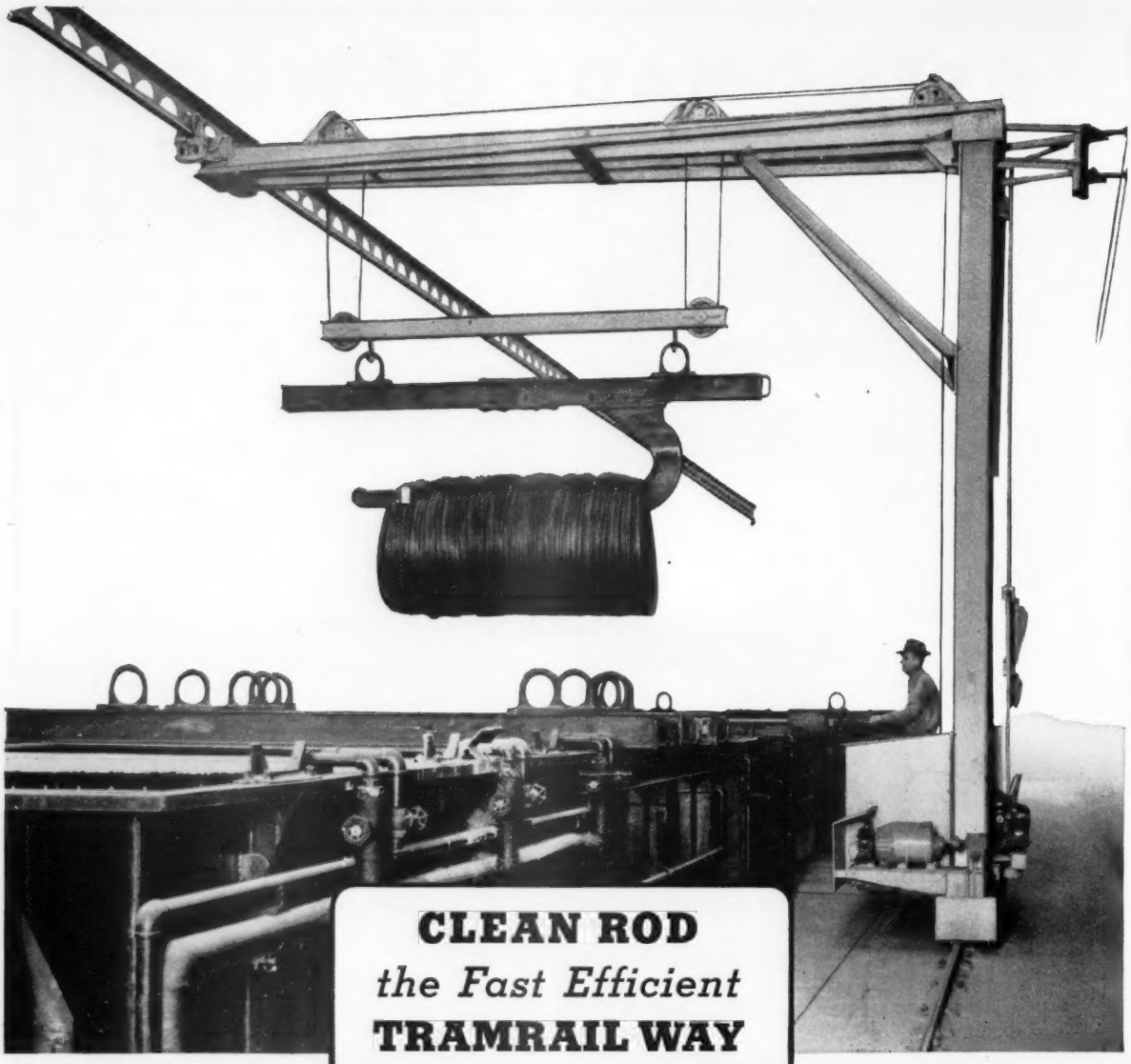

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the Fast Efficient
TRAMRAIL WAY

With a Cleveland Tramrail Cleaning House Gantry Crane a cleaning house can be organized to secure the advantages of straight line production efficiency. This cuts space required, enforces cleanliness and better working conditions. Of prime importance it speeds production and brings down costs tremendously.

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set the pace for Modern Wire Mills

Photographs of Wire Mills courtesy of The Vaughn Machinery Company

Firthaloy is constantly improving carbide die design to meet the ever-increasing speeds, rigid specifications and greater pressures of modern wire mills. Firthaloy "shirt sleeve" Field Service is on the job daily, helping customers in their own die rooms to get maximum production from their own equipment.

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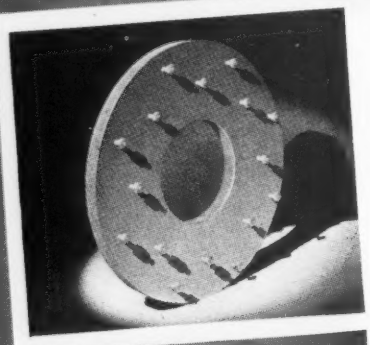
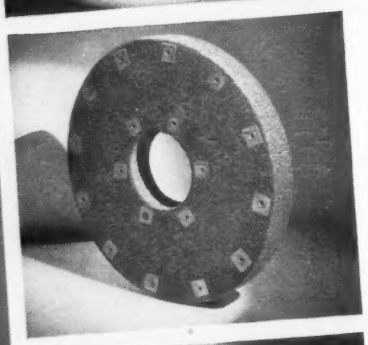
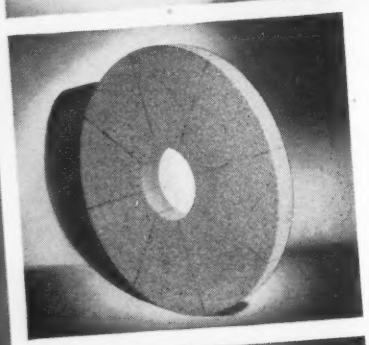
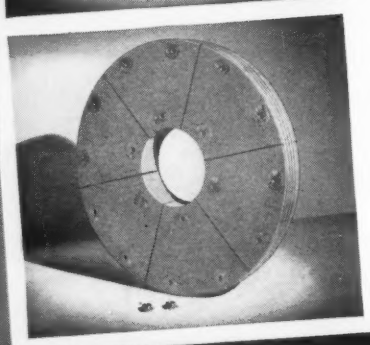
A Disc of the Right Combination . . for Every Spring Grinding Job!









That's What NORTON Offers You!

- **Right Combination Means**—A disc of: (1) the **right abrasive**—fast, cool-cutting 32 ALUNDUM, or sharp, tough 57 ALUNDUM abrasive; (2) the **right bond**—vitrified; (3) the **right grain size;** (4) the **right grade;** (5) the **right structure**—Open or "P" Type; and (6) the **right type of mounting.** Norton discs are available with many different combinations of these six important elements. There's a disc which will cut fast and cool, wear evenly, resist grooving, and require a minimum of dressing for each of your spring grinding jobs.

- **Several Disc Types Available**—The first two illustrated here—solid plate mounted and solid inserted nut—are recommended for grinding small, or medium diameter wire springs where pressure and heat generated are moderate. The second two types—segmental plate mounted and segmental inserted nut—are recommended for grinding jobs on heavy or large diameter wire springs where considerable pressure is used and high temperatures are generated.

- **Take Advantage of Norton Service**—Let a Norton abrasive engineer study your spring grinding jobs. He'll take into consideration the type of grinder used, the method of operation, the material ground, the size and shape of the work, and the finish desired. Then he'll recommend a Norton disc of the **right** combination.

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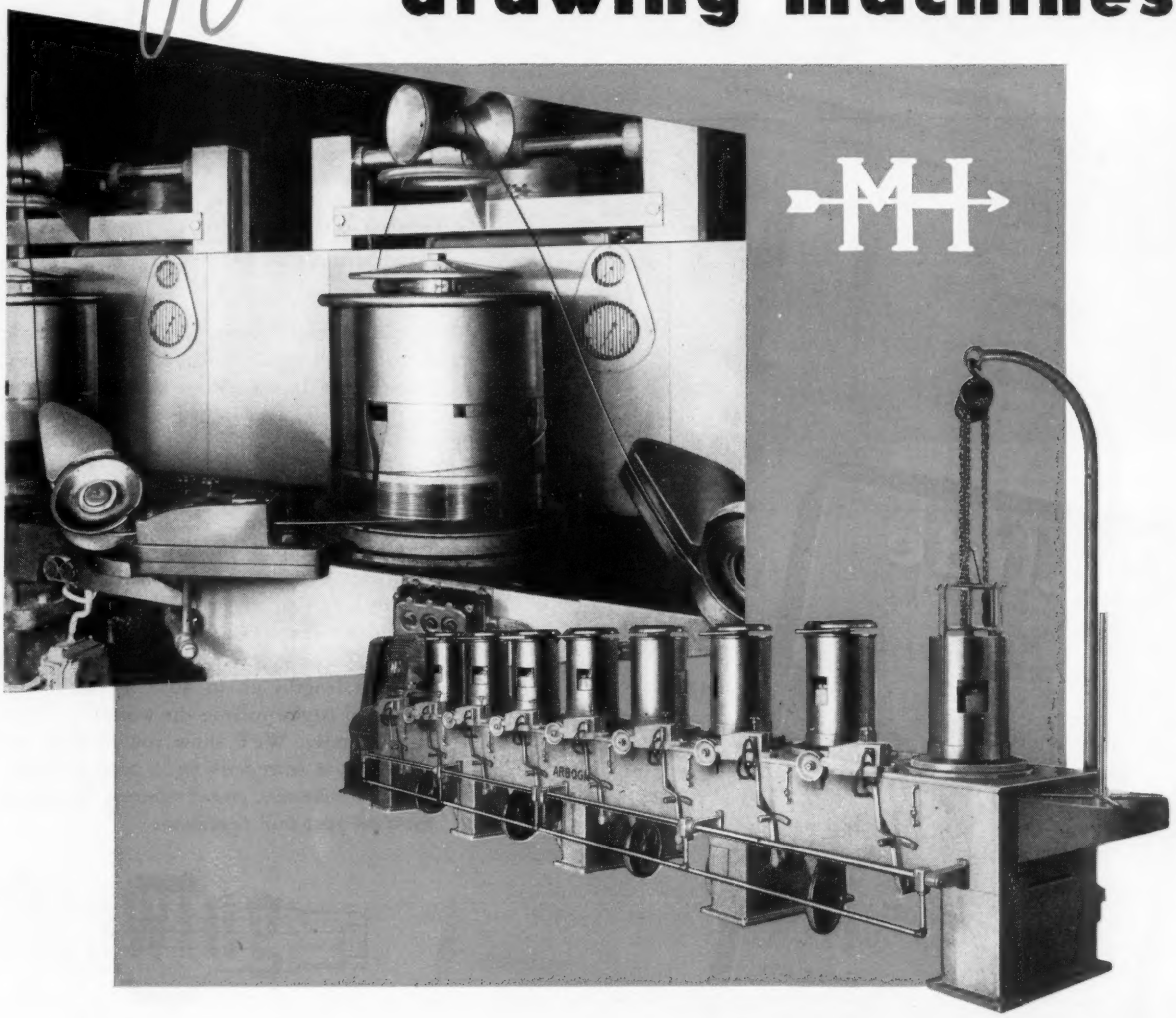
NORTON®
ABRASIVES

Wire drawing machines



We manufacture drawing machines for drawing wire from rod max. ¾" down to 0.005" diameter of any ordinary material—ferrous and non-ferrous metals—and fitted with one or several blocks.

May we have your inquiry?

MORGÅRDSHAMMAR

MORGÅRDSHAMMARS MEK. VERKSTADS AB · MORGÅRDSHAMMAR · SWEDEN

7 Reasons why mills use Talide Rolls

Talide Work Rolls

Solid Carbide Rolls
(weighing up to 1000 pounds)
for Strip or Sheet

1. MORE PRODUCTION
2. BETTER FINISH
3. HIGHER SPEEDS
4. LESS DOWN TIME
5. CLOSER TOLERANCE
6. GREATER REDUCTION
7. FEWER REJECTS

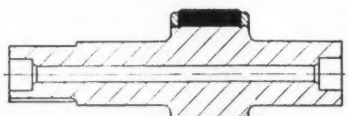
Talide (TUNGSTEN CARBIDE) MEETS EVERY REQUIREMENT

● Profitable, increased tonnage with Talide Carbide Rolls can be had Mills regularly report astounding new figures. What's more, increased operating speeds and improved surface finish make subsequent polishing and buffing unnecessary.

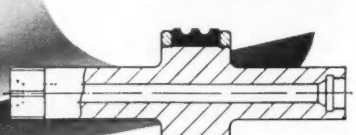
Talide Tungsten Carbide Rolls are used for ordinary finish or mirror-finish on such items as cold rolled stainless, spring steel, razor steel, alloys, carbon, aluminum foil, tinsel ribbon and flat wire.

Metal Carbides Corporation originally developed the art of making Carbide Rolls, and only this firm makes solid or sleeved Talide Carbide Rolls weighing up to 1000 pounds. Available in diameters up to 10" and lengths up to 40". We make the smallest and largest rolls in the world!

Write us today. We'll show you how to get *more production, better finish, higher speeds, less down time, closer tolerances, greater reductions* and *fewer rejects* on your mill operations



Sleeved Rolls for Flat Wire



For Shape Wire

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METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

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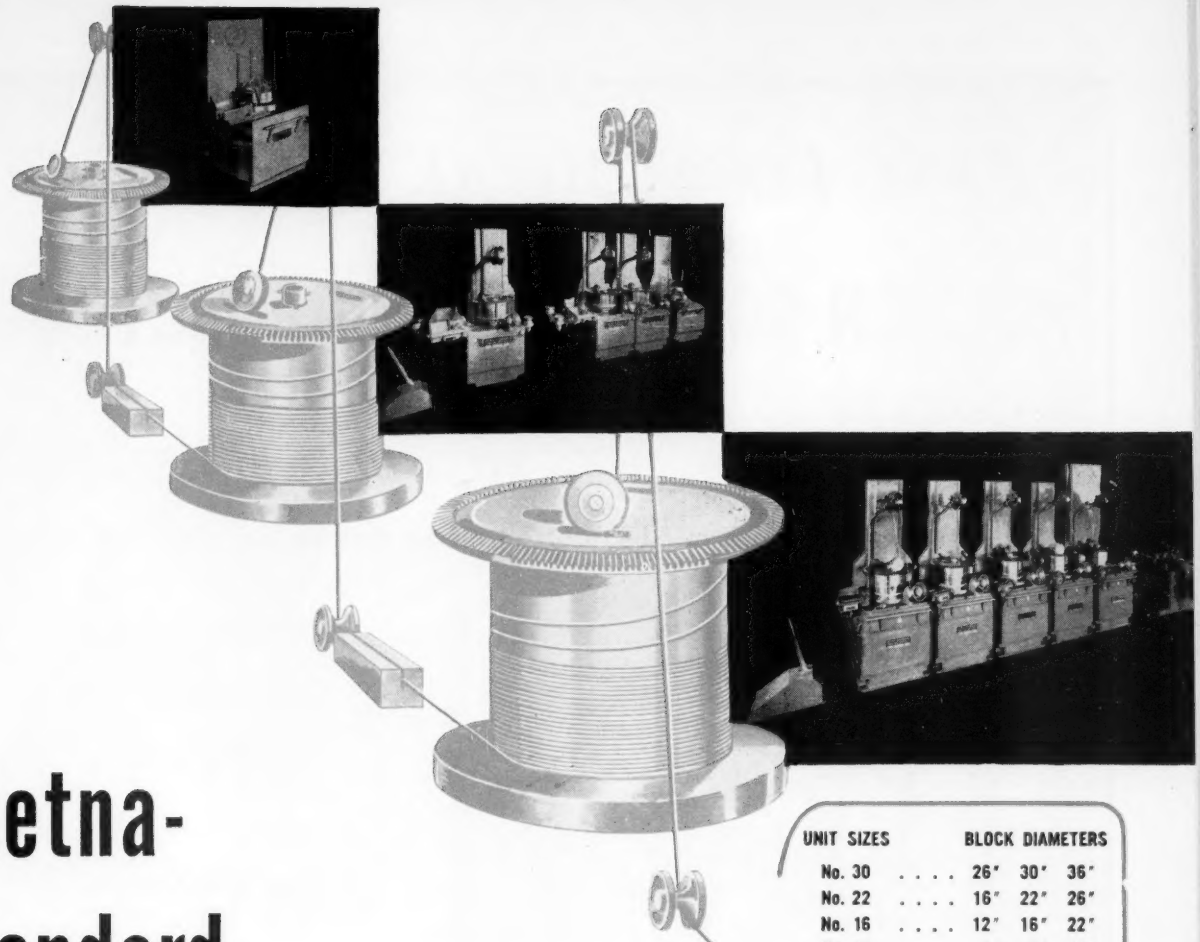

Aetna-Standard Wire Drawing Unit

UNIT SIZES	BLOCK DIAMETERS
No. 30	26" 30" 36"
No. 22	16" 22" 26"
No. 16	12" 16" 22"
No. 12	8" 12" 16"

● **Profitable Production**—Aetna-Standard Vertical Wire Drawing Machines are engineered to most effectively utilize the elements of labor, time, and space. Compact, sturdy construction assures long service at maximum production with a minimum of maintenance.

Efficiency and economy are inherent characteristics of Aetna-Standard construction. Proper arrangements of units to fit your production requirements can make every unit a continuous producer.

Tonnages are increased to a new level through Aetna-Standard design. Controlled water cooling of both dies and blocks, improved die boxes and holders, and auto-rheostatic synchronization between units all contribute to ease of operation and increased production.

New, usable versatility allows future rearrangement of individual units, and interchangeability of unit components (motor gearing and blocks, etc.). This is your insurance against obsolescence. The overhead wire take-off system offers many diversified adaptations and a wide range of draft schedules.

Automatic rheostat synchronizing control utilizes full speed range of each motor, effectively synchronizes speed of all units controls reserves of wire on intermediate units, and provides **simple and safe automatic operation.** Ease of operation means greater production.

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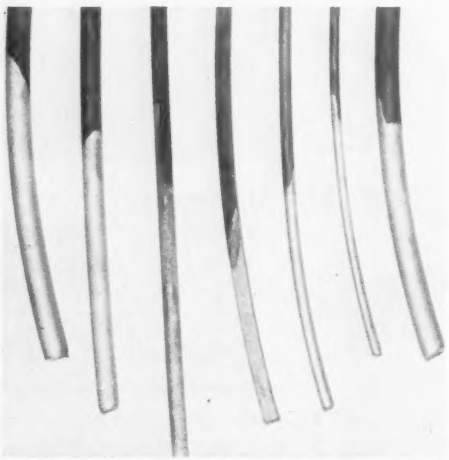
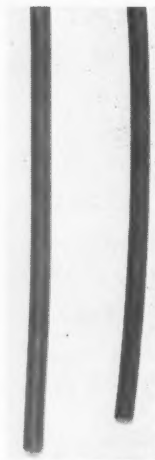
in descaling RODS, WIRE or STRIP of all metals that do not react with sodium hydroxide. For example:



No. 303 Stainless Steel Rods and Wire Descaled by Holden Method. Lower Ends Brightened by Passivating.



Same Steel, Except Treated with Holden 4 X Black after Passivating.

CARBON STEELS

STAINLESS STEELS

ALLOY STEELS

COPPER ALLOYS

NICKEL ALLOYS

CHROME ALLOYS

Low operating temperatures (700°F) are well below critical points for most metals. HOLDEN FURNACES offer relative SPEED, EFFICIENCY and ECONOMY in either CONTINUOUS or BATCH cleaning. Work can be left in bath without any damage to the metal. Method is SAFE, SIMPLE, DEPENDABLE. Descaling operation is limited to simple immersion and sodium is easy to handle.

HOLDEN FURNACES are made for all HEAT-TREATING operations, including AUSTEMPERING, MAR TEMPERING, ANNEALING

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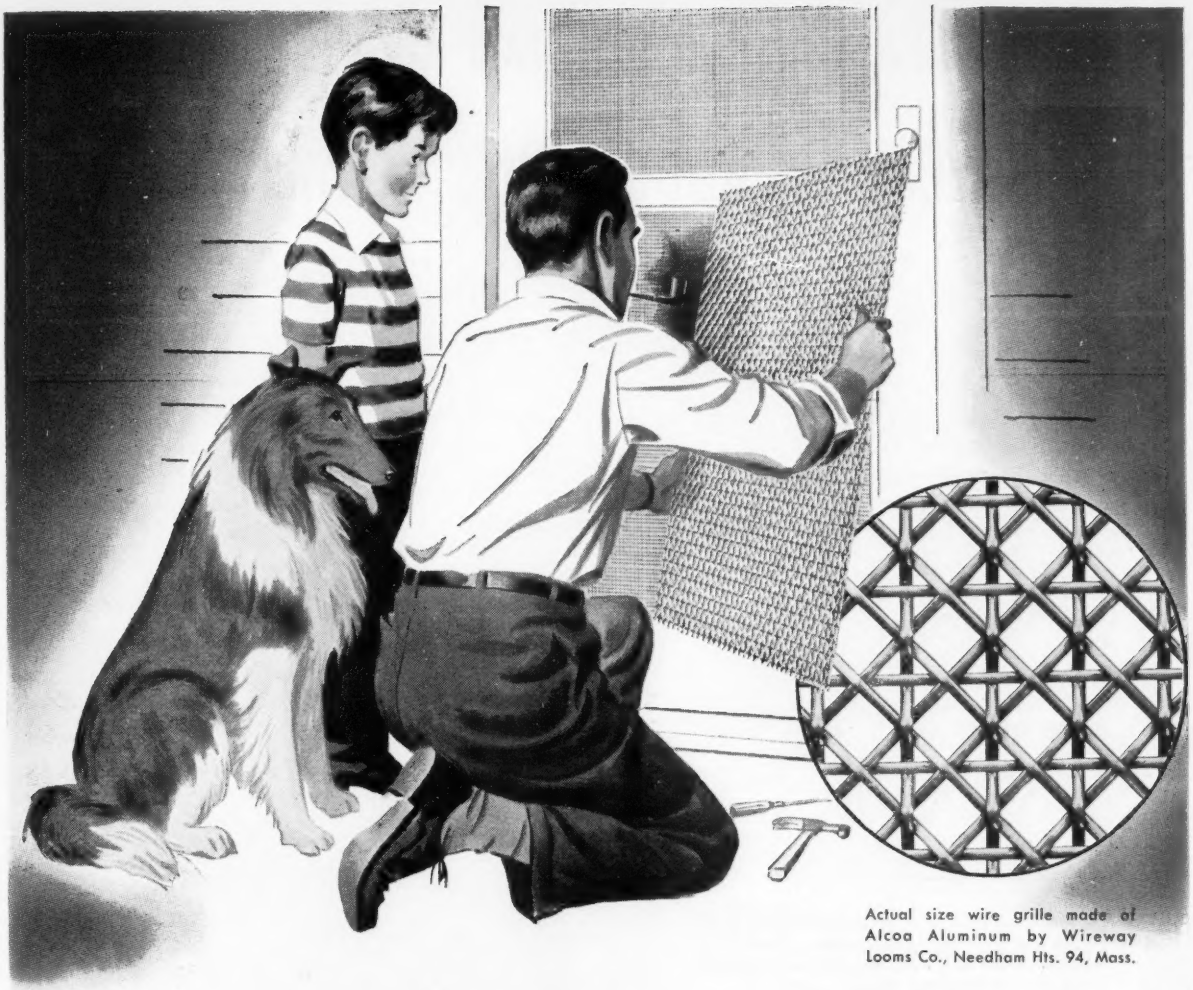

Actual size wire grille made of Alcoa Aluminum by Wireway Looms Co., Needham Hts. 94, Mass.

ALUMINUM LASTS

an added sales feature for your wire goods

The strong, lustrous wire grille he's installing will never streak with red-rust. He's learned, as thousands have, that products last when made of Alcoa Aluminum.

Make this highly salable feature a part of your wire goods. The cost is low, for a pound of aluminum goes three times as far as heavy metals. Forming is easy on your present equipment. And finishing you eliminate altogether.

For complete information, call your local Alcoa sales office listed under "Aluminum" in your phone book. Or write: ALUMINUM COMPANY OF AMERICA, 1950D Gulf Building, Pittsburgh 19, Pennsylvania.

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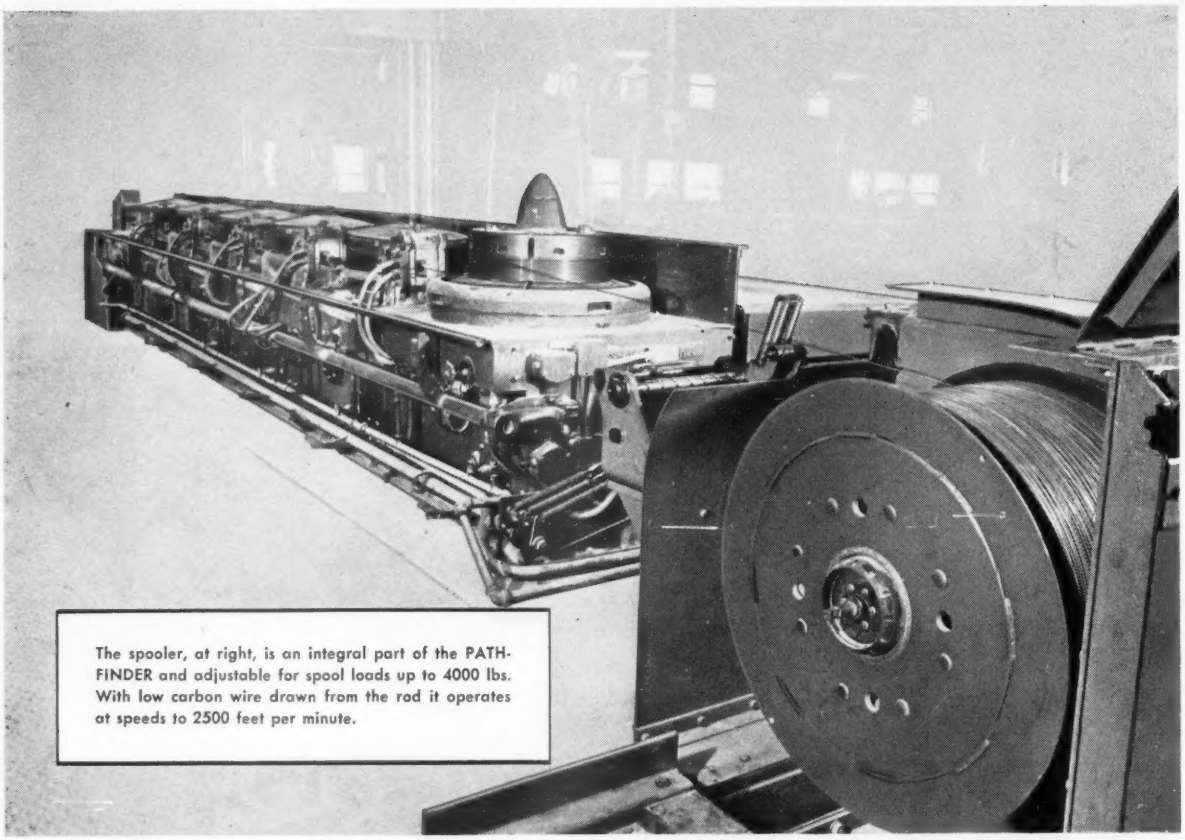
Now you can get new highs in SAFETY... PRODUCTION... QUALITY



The spooler, at right, is an integral part of the PATHFINDER and adjustable for spool loads up to 4000 lbs. With low carbon wire drawn from the rod it operates at speeds to 2500 feet per minute.

YOU GET an amazing number of advantages in the Marshall Richards PATHFINDER Multi Hole Wire Drawing Machine... For one thing, less friction at the die, plus efficient cooling, permit drawing at much higher speeds and with a consequent improvement of quality . . . Still another feature is the cold-cathode grid-controlled Mercury-Arc Rectifier which produces with D.C. motors the complete range of speeds needed for drawing all metals, and a minimum speed for maximum safety in threading up.

Marshall Richards PATHFINDER is available with from two to six drawing blocks. It is outstanding for drawing ferrous and non-ferrous materials and sections requiring up to 6000 lbs. pull at the first die. A typical five-hole machine draws high carbon steel at speeds to 1600 feet per minute.

Write for full information about the PATHFINDER or the complete line of Marshall Richards equipment for drawing wire in all metals from .0004" to 1 inch.

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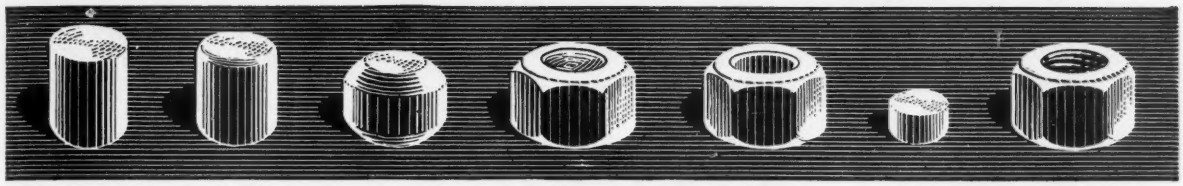
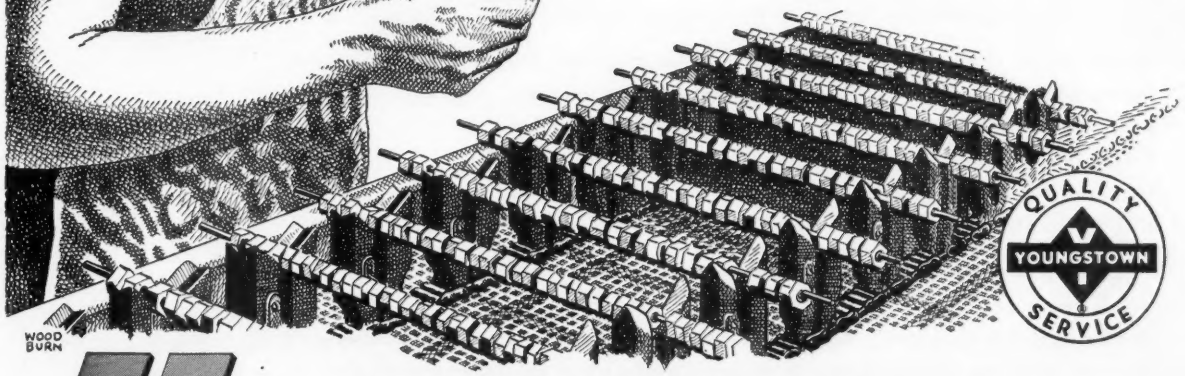
D R A W O N O U R E X P E R I E N C E



For Minimum Rejects

FROM first to last, nuts formed from Youngstown Scrapless Nut Quality Wire stand strict inspection--by magnetic particle or the usual visual inspection methods. That's because Youngstown Scrapless Nut Quality Wire comes to you so free from piping, seams, laps, die marks, internal tearing and cupping and nonmetallic inclusions.

Available in various compositions including AISI standard as well as special sulphurized steels.---Cold heading bolt wire, of comparable quality, in all standard carbon analyses available for prompt shipment to the bolt and nut industry.



Youngstown

SCRAPLESS NUT QUALITY WIRE

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If you want steel wire of any size, temper, analysis or finish, send your order to Wickwire Spencer. We'd like to add your name to our list of satisfied customers.

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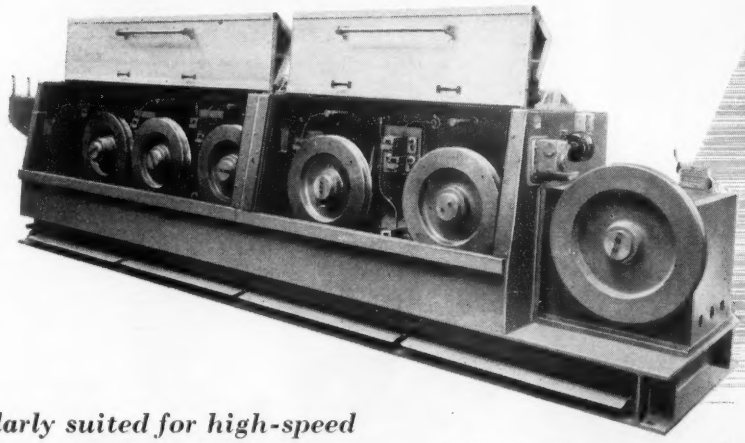
PACIFIC COAST SUBSIDIARY—THE CALIFORNIA WIRE CLOTH CORP., OAKLAND 6, CAL.

CF&I

Heavy Duty, Continuous, Tandem Wire Drawing Machine For Heavy Rods



Particularly suited for high-speed continuous drawing of aluminum, copper, brass, bronze or other non-ferrous materials.

Incorporates any multiple of dies from 6 to 10.

Can be furnished with a vertical finishing block for a coiled product—or with conventional type of horizontal capstan for direct spooling.

Typical of all Syncro heavy duty machines, this wire drawing machine is rugged for day-in, day-out trouble-free operation.

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It's all new—specially designed and built to meet the needs of the wire industry.

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There's a standard Syncro Machine for every wire drawing need, from rod to fine wire — from strands to cable.

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We think our special kind of knowledge and the formulas we've developed through the years can be a help to you — and we invite you to make full use of that help. There's a STANDARD Service Engineer ready to lend a skilled and knowing hand with any lubricating or finishing problem you may have.

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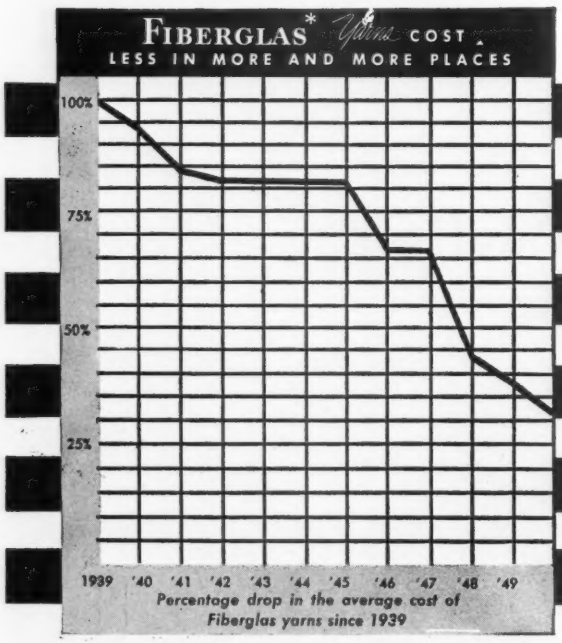
FIBERGLAS* *Yarns*


FIBERGLAS* Yarns COST
LESS IN MORE AND MORE PLACES
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50%
25%
1939 '40 '41 '42 '43 '44 '45 '46 '47 '48 '49
Percentage drop in the average cost of Fiberglas yarns since 1939

- WILL NOT BURN
- WILL NOT ROT
- WILL NOT ABSORB MOISTURE
- HAVE GREAT TENSILE STRENGTH
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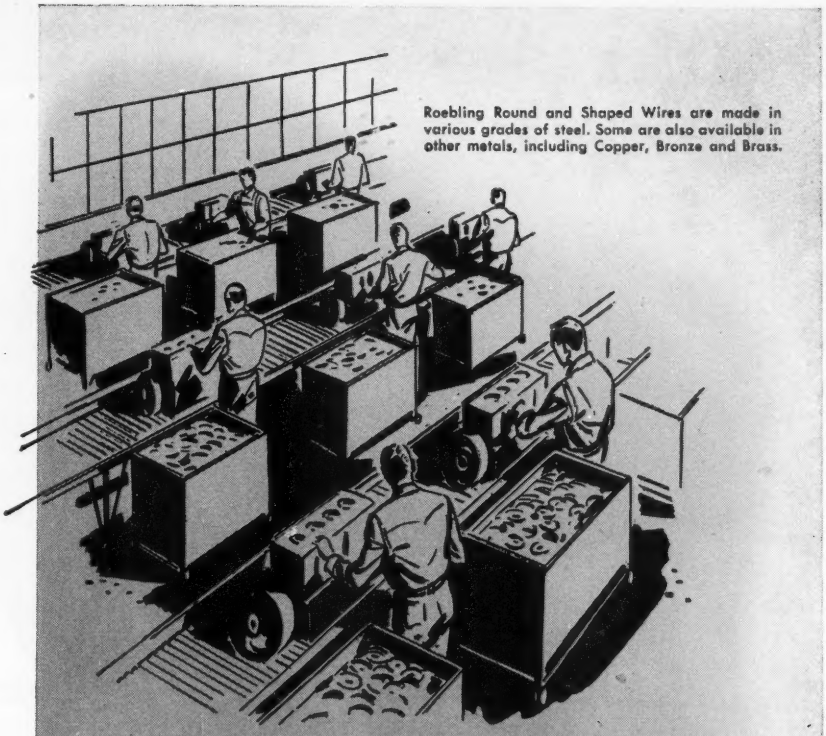
- LOW COST!

*Fiberglas is the trade-mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.

For complete information about Fiberglas yarns for this and other uses write Owens-Corning Fiberglas Corp., Industrial Textile Sales Division, Dept. 875, 16 E. 56th Street, New York 22, N. Y.

OWENS-CORNING FIBERGLAS *Yarns*



Roebling Round and Shaped Wires are made in various grades of steel. Some are also available in other metals, including Copper, Bronze and Brass.

Every inch dependably uniform... that's why users say...

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HANLON-GREGORY
GALVANIZING COMPANY *says:*

"For 20 years we've used nothing but Monel Tie-rods on our pickling tanks!"

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25 years ago, this company gave Monel tie-rods a trial. As a result, tie-rods of Monel have become standard equipment, and for the last 20 years they have been used exclusively, together with corrosion-resistant Monel nuts and washers.

The Superintendent points out that the Monel tie-rods are so tough, so strong that the timber in the tanks can be very tightly bolted together. Leakage is minimized. Result: his tie-rods stay in good condition through many years of service, are able to keep his tanks tight longer.

For over 40 years, Monel has excelled in all types of pickling equipment. It is strong and ductile. It resists pickling acids better than any other commonly used material. It is easily welded.

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DESIGNERS and MANUFACTURERS! Sand castings and precision castings of Monel, Nickel, Inconel* and other Nickel alloys are available from Inco's own foundry.

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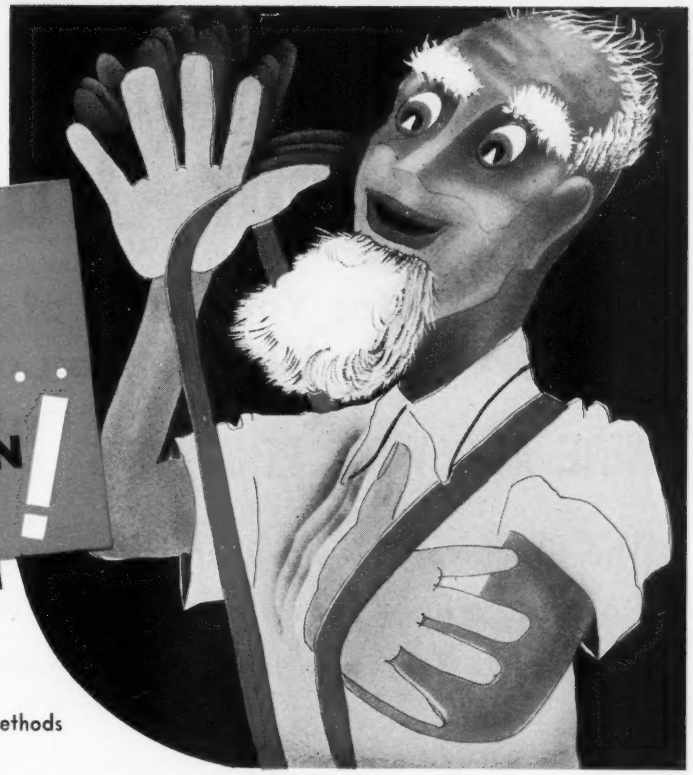

The finest carbide dies that scientific production methods can produce—now at

LOWER COST

Hartley WIRE DIES are not merely low in cost so that you make initial savings; they are uniform in quality, tops in quality and made as only long-experienced craftsmen can make them. HARTLEY DIES are GUARANTEED.

It is no longer necessary to guess as to the quality of your dies if you buy Hartley dies, nor to speculate on the question of die efficiency and maximum production of wire. These characteristics are built into each Hartley die to keep your wire costs at the lowest possible point.

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UPRIGHT ★ ★ ★

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Wire Drawing Machines

FOUNDED WATERBURY FARREL 1851

THESE high speed machines are available in several sizes and can be had with either a coiling block or spooler. The spooler may be an attachment or a separate floor-type device, such as shown. This is the No. 4 machine with belt-type cradle spooler. It is driven by a direct-coupled motor (not shown), has 13 dies and capacity for drawing copper from ¼" maximum starting size down to a finishing size of from No. 10 to No. 18 B. & S. gage. The dies and the hardened steel drawing rolls are enclosed by a rolling steel curtain to confine the splash of the drawing lubricant.

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FOUNDRY & MACHINE COMPANY
Waterbury, Connecticut, U. S. A.
SALES OFFICES: CHICAGO CLEVELAND NEWARK, N. J.

Be Sure to be in Peoria May 11 and 12

for the

Mid-West Regional Meeting of the Wire Association

At the Pere Marquette Hotel, Peoria, Ill.

Program Chairman: John A. Moritz, Supt. Wire Mills,
Keystone Steel and Wire Co., Peoria, Ill.

THE PROGRAM

THURSDAY, MAY 11, 1950—Chairman of Meeting: Curtis Voightlander, Union Wire Rope Corp.

2 P.M.—PAPER: CARBIDE WIRE DRAWING DIES—BEARINGS vs. NO BEARINGS, by Jack Tompkins, Chief Chemist, Keystone Steel & Wire Co. This paper is the result of six months of experimentation on the subject in Keystone's plant.

3 P.M.—PAPER: APPLICATION AND USE OF LUBRICANT COATINGS, by Floyd M. Hauger, Vice Pres., Standard Industrial Compounds Co. The author discusses a revolutionary method in the application of wire and metal drawing lubricants.

6:30 to 7 P.M.—COCKTAILS—Courtesy of Standard Industrial Compounds Co.

7 P.M.—BANQUET in La Salle Room of Pere Marquette Hotel.

SPEAKER—The Hon. Everett M. Dirksen, Ex-Congressman from the 16th District, Illinois. In Washington, Mr. Dirksen was considered among the top three speakers in the House. Is now running for U. S. Senator from Illinois—a very able and forceful speaker, well-worth hearing.

FRIDAY, MAY 12, 1950—Chairman of the Meeting: Ralph B. Roth, Vice Pres., Ludlow Saylor Wire Co.

9:00 A.M.—PAPER: ALUMINUM WIRE, by C. J. Beneke, Mgr., Reynolds Metal Co., Louisville, Ky. The paper will dwell on various aluminum wire drawing problems and the uses and applications of aluminum wire.

10:15 A.M.—Buses will leave the hotel for the Keystone plant.

10:30 A.M.—GENERAL PLANT VISIT through Keystone Steel and Wire Company's wire mills.

12:45 P.M.—Luncheon in Keystone's ultra-modern cafeteria as guests of the Keystone Steel and Wire Company's Management, followed by round table discussions. This will conclude the Regional Meeting.

REGISTRATION FEE: A fee of $6.00 will be charged for each person, which will include the Banquet and the trip to the Keystone plant and return.

The Program Chairman, the Meeting Chairmen and the speakers are to be congratulated for their joint efforts in arranging what is considered one of the finest Regional meetings for your benefit. You are cordially invited to attend and we urge you to make immediate arrangements to be present.

Please make your hotel room reservations at once through this office.

THE WIRE ASSOCIATION

RICHARD E. BROWN, Executive Secretary

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THE MACNAMARA

range of wire and strip forming machines

M.I.9

Wire and Strip Forming Machine

A medium capacity automatic for high speed production of wire forms up to 8½" developed length. Light strip forming may also be undertaken, an additional slide being provided for piercing and crimping. The M.I.9 is built for high speed performance with roller bearing high tensile shafts for power transmission, light reciprocating parts and heavy, easily set camming.

M.I.3

Automatic 3-slide Wire Forming Machine

Here's the machine to increase your output of small wire forms, a vast range of shapes can be produced at rates up to 18,000 parts an hour, and one operator can easily supervise six machines—that's 108,000 parts from one operator per hour! There's also a model for chain making which produces completed chain at 12,000 links per hour.

M.I.4

Automatic Multi-Slide Machine

The ability to rearrange the slide positions according to the job ensures that wire and strip forms are handled with the greatest facility. After setting in the vertical position, the head of the machine can be inclined forward to allow easy delivery of the finished work. Up to six slides can be added and subtracted at will, as separate units. Speed is variable in steps up to 250 parts per minute.

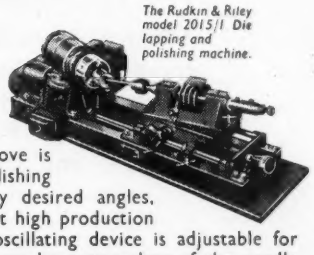
M.I.7

Automatic Multi-Slide Strip and Wire Forming Machine

Designed to produce simple or complex forms from continuous self-feeding coiled stock, this machine eliminates separate press operations. Multi-slide methods enable eight or nine follow-on press or bending operations to be performed and an infinite variety of wire and strip forms can be produced at an average rate of 9,000 parts per hour.

RUDKIN & RILEY machines

for Wire Die production



The Rudkin & Riley model 2015/1 Die lapping and polishing machine.

The Rudkin & Riley range comprises high production machines for the manufacture and servicing of diamond, tungsten carbide and other hard metal dies. These machines include :

Five-Head Vertical Piercing and Polishing Machine for Diamond and Tungsten Carbide Dies.

Hand-Polishing Machine for Diamond and Tungsten Carbide Dies.

Ten-Head Diamond Die Polishing Machine.

Shaped Die Lapping Machine for ripping, lapping and polishing dies of regular or irregular shape.

The model 2015/1 shown above is a high speed lapping and polishing machine which produces any desired angles, bores or radii automatically at high production rate. The unique positive oscillating device is adjustable for pressure, and the headstock can be swung clear of the needle spindle for inspection and hand polishing. The machine has a high rate of carbide removal, and adjustments can quickly be made to cover every operation on wire, rod and tube drawing dies.

THE BRITISH TOOL, MACHINE TOOL AND SCIENTIFIC INSTRUMENT SECTION, CANADIAN INTERNATIONAL TRADE FAIR TORONTO 29 MAY - 9 JUNE 1950

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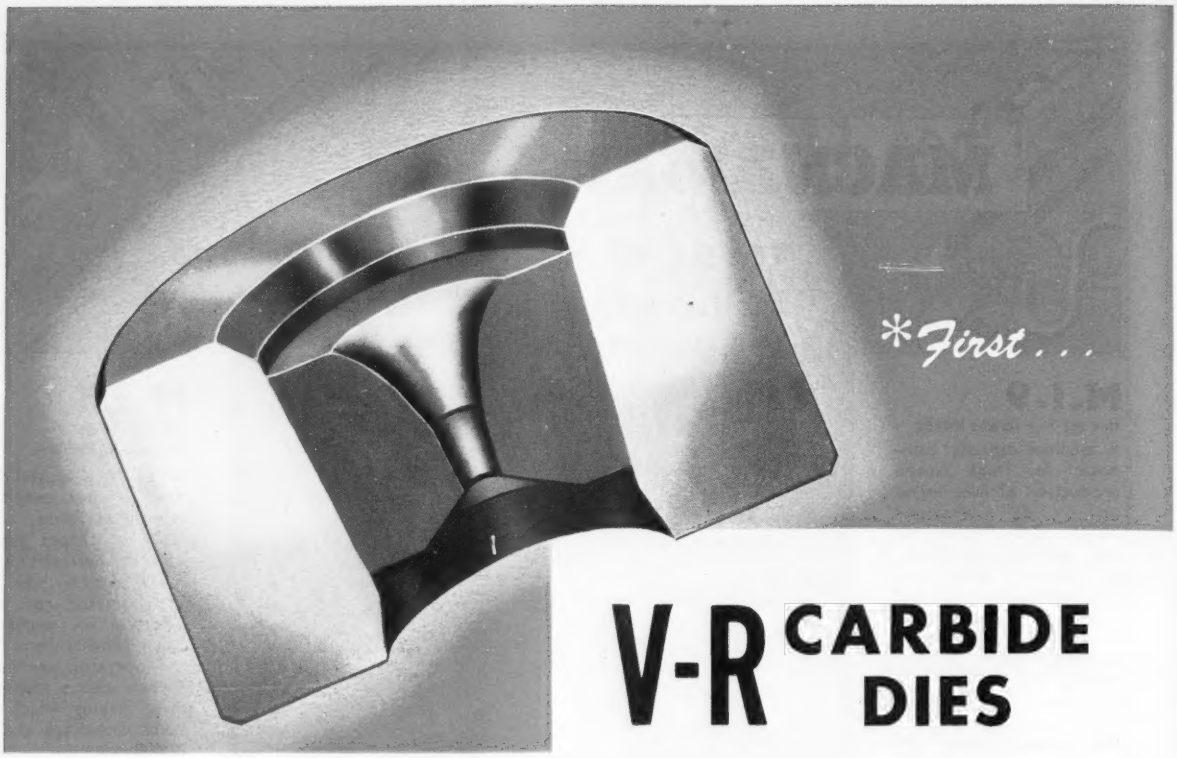

V-R CARBIDE DIES

mean . . . high tonnage output at minimum cost

V-R Carbide Dies combine every advantage known to the wire industry.

V-R Carbide Dies, R-1 thru R-6 with the NEW higher nibs are completely redesigned to improve drawing conditions and to allow for heavier drafting practice.

Eliminate unnecessary maintenance and cost NOW by changing to V-R Carbide Dies—The World's Finest!

* First to develop extra wide tapered front and back openings for easy inspection and maintenance. No steel to cut when resizing or refinishing V-R Dies.

* First to design and develop the tapered nib construction increasing internal strength and providing perfect die concentricity.

* First to manufacture Carbide Die with preformed rough cored back relief to eliminate costly die room coring operations over the entire range of hole sizes.

* First to furnish Carbide Dies rough cored to finish, at hole sizes below .015". These rough cored dies are available in dies sizes R-O, R-1, and R-3, rough cored at .004" and .010".

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The Wire Outlook

With the settlement of the coal strike, steel mills are again hitting their stride and all industry is breathing easier. Steel tonnage dropped to 88.9% of capacity in February, against 93.9% for January, but ingot production as a whole for the year should be near that of 1948 and 1949. Nearly 100,000,000 tons of ingots could be produced now were there no interruptions.

While the coal settlement may be deplored insofar as it gave miners a fourth-round of wage increases, plus their welfare and royalty demands, the long term of the contract and the five-day working week give some assurance of stability to industry. An administration sympathetic to labor and apathetic toward law enforcement made the mine owners' capitulation in the matter of acceding to Lewis' demands a practical necessity. Other unions will now be formulating new wage demands.

Most economists are revising their earlier estimates of possible uncertainty for the second half of the year and a feeling of greater assurance prevails. Unemployment will not be serious—there is always some—and business should be good, winding up close to 1949's levels.

The House has adopted the conference report on the Basing Point Bill, that would legalize freight absorption in pricing where it is done in good faith to meet competition, and the bill has been passed on to the Senate for study. Much good would accrue to the nation through its early passage.

The Reconstruction Finance Corporation withdrew its selling prices on tin on March 13th, in a surprise announcement, which took the RFC out of the market as a supplier of tin to private industry. Pending determination of the effect of this move on prices, the tin markets have been quiet.

There is little prospect that zinc or copper will be reduced in price as many buyers have hoped. Markets have been strong and the reverse is more likely. Lead has been soft due to an easing in government buying. No one should count on substantial price reductions anywhere along the line—high wages, a too-high level of government expenditures and an over-large national debt peg prices so that the only way they can move is up, as a long-range trend.

The demand for low carbon wire is good, music wire is more active and the call for springs of a wide variety is increasing. Bookings on most types of manufacturers' and merchant wires are running two to three months ahead. More bolt and screw manufacturers are buying finished wire instead of drawing from rods, many large concerns letting their wire drawing equipment lie idle. Many consider this a healthy trend, and if widely practiced would keep wire mills busy making rods and wire, with the product fabricators concentrating on their own main objectives. The demand for fasteners is good and the industry expects a satisfactory year.

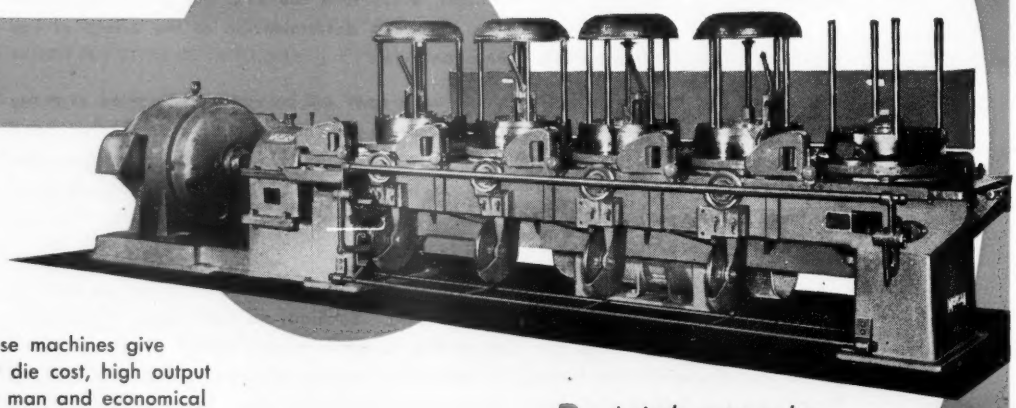
With the industrial atmosphere cleared for steadier production schedules, with no major labor disturbances on the horizon, management should be able to do a little forward planning with greater certainty than at any time since the war ended. Business life today may not be simple, but relatively speaking, it is good to look ahead and feel that the outlook is not too cloudy.

—from the Editor's Desk

5 big reasons for replacing with MORGAN-CONNOR WIRE MACHINES

1 Air cooling inside and outside the block with extended time delay between drafts makes a highly efficient cooling system

2 The efficient cooling system permits the drawing of high carbon wire at high speed



3 A single motor makes the maximum use of power and requires a minimum of maintenance

4 Either alternating current or direct current can be used to operate Morgan-Connor Machines

5 These machines give low die cost, high output per man and economical use of floor space

WM-46

Morgan Construction Company • Worcester, Massachusetts

WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 25 APRIL, 1950 No. 4

Designated as

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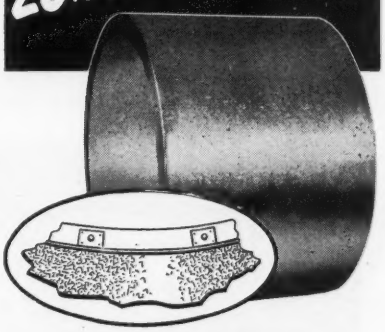
Extra strength
Extra service
and
20% less weight



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"Reinforced Type"

FLANGED STEEL TRAVERSES

for wire and cable

. . . have extra strength where it is needed most—at bolt holes and base of the flange. This reinforcing makes possible the use of lighter gauge steel, saving up to 20% in weight while increasing overall strength.

Niles Flanged Steel Traverses have given as much as sixteen years' service without refinishing or major maintenance, according to actual experience records. In many cases their use has doubled the number of trips per reel before cut downs or scrapping of wooden heads.

They are manufactured in sizes up to 56" diameter and 48" traverse —in plain, painted or hot dip galvanized finishes—as light as 18-gauge steel. Width of flange and number of bolt and drain holes are furnished to your specifications. Available for prompt delivery. Write for prices.

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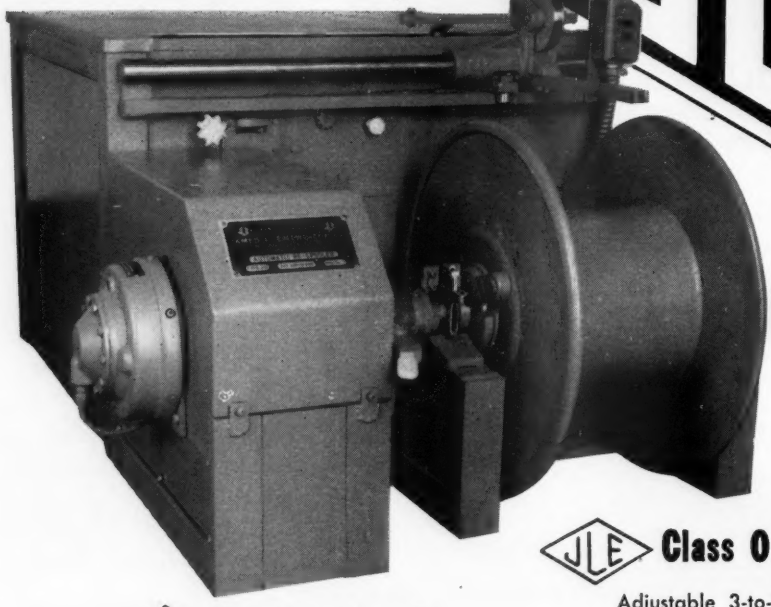

Individual Drive-Brake-and-Traverse Re-Spoolers

JLE Class O Re-Spooler

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Flexible High Temperature Electrical Insulation

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This study of High Temperature Electrical Insulation embodies the latest developments on silicone rubber coated fiberglas cloth, and should prove of timely and prime interest to those using various silicone tapes in the manufacture of insulated electric cable.

Introduction

DURING the past two years, there have appeared in the technical literature numerous articles describing the successful use of high temperature electrical insulation in motors and transformers. Recent developments in cable insulation have resulted in the Bureau of Ships issuing a cable specification, 15-C-14, covering high temperature cable insulation.

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SINCE motors, generators, transformers and cables are now commercially available utilizing Class "H" or high temperature insulation, it will be of interest to review the basic electrical and physical properties of these flexible Class "H" materials.

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Scope

MATERIALS to be suitable for high temperature electrical insulation must be stable physically and chemically at elevated temperatures in the range up to 200°C. Glass fabrics and asbestos in the form of cloth or paper suggest themselves as basic carriers for this insulation. Used in their original state, both glass and asbestos have the necessary thermal stability for high temperature electrical insulation. They do not however possess the necessary electrical properties.

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IT is therefore necessary to impregnate or coat these carriers with suitable high temperature resins and rubbers to make them entirely satisfactory for use on electrical equipment. The impregnation and coating of these carriers then becomes the important step in the production of a suitable high temperature electrical insulation. While the coating resins available cannot as yet match the thermal stability of glass and asbestos, the silicone resins and rubbers will lend themselves to operation at temperatures up to 200° Centigrade.

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THE scope of this paper will be limited to those flexible high temperature Class "H" insulations comprised of glass fabrics and asbestos in combination with silicone resins, silicone rubber and mica. The following products will be discussed in detail:

1. **Silicone resin coated fiberglas cloth.**
2. **Silicone resin coated asbestos paper.**
3. **Silicone resin coated glass-mica.**
4. **Silicone rubber coated fiberglas cloth.**
5. **Special silastic rubber coated fiberglas R-12 and R-20.**

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Silicone Resin Coated Fiberglas Cloth

SILICONE resin coated fiberglas is the most widely used of all flexible Class "H" materials. This is undoubtedly due to the fact that it was the first product to be developed. Since its introduction some eight years ago, it has been steadily improved so that today it is giving satisfactory performance in a large number of uses such as cable insulation, layer insulation for high temperature transformers and phase and coil insulation for motors.

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THE greatest improvement in this product came after special high temperature coating equip-

TABLE 1

Electrical and Physical Properties Silicone Resin Coated Fiberglas

Thickness	.004"	.007"	.010"	.012"
Wt/Sq. Yd.	0.27	0.47	0.69	0.85
Tensile Strength P.I.W.	100	135	190	250
¼" Electrodes—V/Mil.	1500	1400	1300	1200
Power Factor 100°C—Dry	1.0	1.0	1.0	1.0
Power Factor—100°C/ 24 hrs./65% R.H.	1.3	1.4	1.4	1.5
Moisture Resistance—% H_2O Absorbed				
After 24 hrs. @ 65% R.H.	0.10	0.15	0.15	0.20
After 24 hrs. immersion	0.70	0.60	0.55	0.55
Chemical Resistance:				
Hot Transformer Oil	Softens	Softens	Softens	Softens
Carbon Tetrachloride	Softens	Softens	Softens	Softens
Alkali Resistance	Good	Good	Good	Good
Acid Resistance	Good	Good	Good	Good

Heat Resistance: Silicone Resin Coated Fiberglas will stand exposure of 1000 hours at 200°C without embrittlement indicating exceptional heat resistance.

ment was developed and put into operation by the Irvington Varnish and Insulator Company and others. Whereas, in the past some silicone resins were cured as low as 300°F, it is now fully recognized that to obtain optimum properties from these products it is necessary to cure these resins at temperatures in the range of 500 to 600°F.

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IN the manufacture of silicone coated fiberglas, certain selected fiberglas fabrics of the right thickness are impregnated by the dip method with the proper silicone resin and cured at elevated temperatures. In order to obtain the desired thickness a minimum of two or more successive impregnations of the resin are applied to the fiberglas cloth in a continuous operation. Between each impregnation the material is exposed to elevated temperature to insure complete drying and curing.

SILICONE resin coated fiberglas thus manufactured is available in full width rolls (36 inches wide) or slit into tape in all thicknesses from .003" to .025". Table I shows the electrical and physical properties of four of the most commonly used thicknesses.

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EXAMINATION of Table 1 shows these materials to have a dielectric strength in the range of 1000 to 1500 Volts/Mil. This is in combination with its excellent heat resistance makes silicone resin coated fiberglas an excellent flexible Class "H" insulation.

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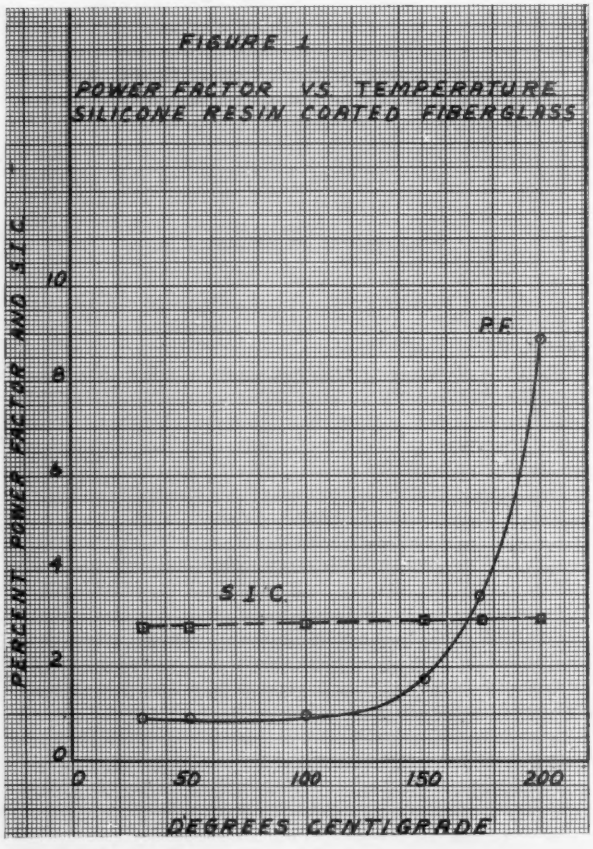
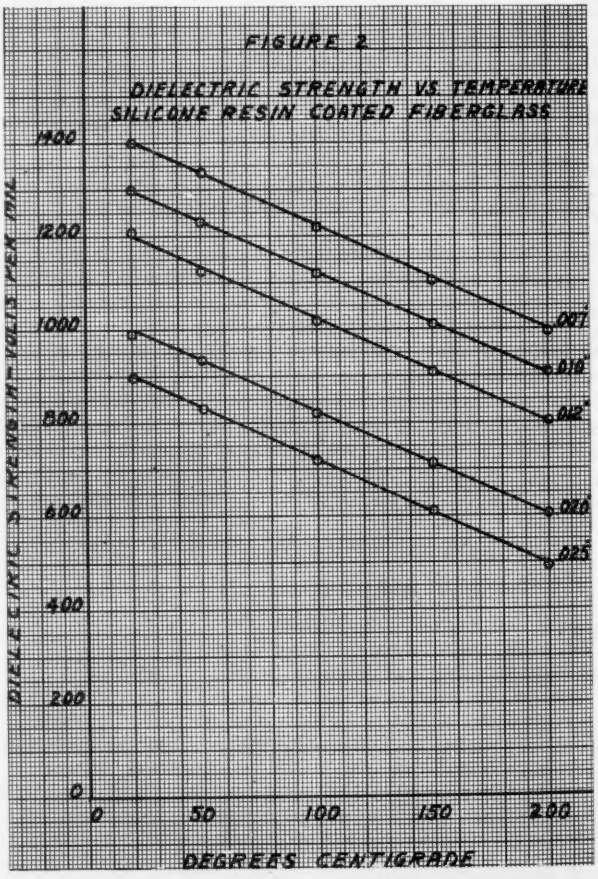
SILICONE resin coated fiberglas has two disadvantages which must always be considered in its application. First, these materials have poor chemical resistance and will soften in hot transformer oil. It is therefore limited to dry type equipment where it will not come in contact with oil. Since, how-





ever, the use of oil on most apparatus is primarily for cooling purposes, the fact that these materials will operate at temperatures up to 200°C makes the use of oil unnecessary. Secondly, these products all have very low elongation making it difficult to tape around irregular surfaces. With proper care, however, coils and irregular shapes can be successfully taped.

* * *

IN Figure 1 is shown the variation of power factor and dielectric constant with temperature. The power factor remains constant at 1.0 percent up to 125°C, at which point it increases rapidly up to 9.0 per cent at 200°C.

* * *

FIGURE 2 shows the relationship between dielectric strength and temperature. With increasing temperature there is a reduction of voltage breakdown. This reduction from room temperature to 200°C amounts to about 35 percent.

* * *

Silicone Resin Coated Asbestos

SILICONE resin coated asbestos has just recently been considered satisfactory for flexible Class "H" electrical insulation even though asbestos cloth and paper have been on the market for many years. The primary reason for this was the fact that these cloths and papers could not be produced in thin enough sheets.

* * *

RECENT developments such as Pyrotex, Quinterra, Terratex and Quinorgo Asbestos Papers have made available to the manufacturers of electrical equipment sheets as thin as .001". Because of the low tensile and tear strength of these thin sheets they must be given special resin impregnations so they can be handled without breaking during winding operations.

* * *

BY far the strongest of these asbestos papers is Pyrotex because of its long fibrous construction. Tensile and tear strength of the Pyrotex Asbestos Paper nas been greatly improved by the proper impregnation with silicone resins so that today it is being used on high speed cable taping machines without difficulty.

* * *

WHEN impregnated and coated with silicone resin, Pyrotex Asbestos Paper has excellent electrical and physical properties as shown in Table II.

* * *

TABLE II

Electrical and Physical Properties Silicone Resin Coated Pyrotex Asbestos Paper

Treatment	.006"—.007" Saturated	.010" Saturated & Coated	.012" Saturated & Coated
Approx. Weight per Sq. Yds.—lbs.	0.29	0.52	0.68
Specific Gravity	0.95	1.17	1.21
Tensile Strength—P.I.W.			
Machine Direction	25.0	35.0	35.0
Cross Machine Direction	15.0	20.0	20.0
Tear Strength—Grams Elmendorf			
Machine Direction	150.	150.	150.
Cross Machine Direction	125.	125.	125.
Dielectric Strength—¼" V/Mil.			
C/96/25/0	200	350	350
C/96/25/96	175	250	250
Heat Resistance– hours			
⅛" Mandrel Bend @ 200 deg. C	1000	1000	1000
Power Factor—C/96/25/0	10.0%	10.0%	10.0%
Water Absorption—24 hours @ 25 deg C.	2.5%	2.0%	1.8%

Silicone Glass Mica

SILICONE coated glass mica tapes have been developed having enough flexibility to perform satisfactorily on conventional cable taping machines. In order to obtain maximum flexibility these tapes are limited to thicknesses under .007". Glass-Mica Tapes in heavier thicknesses have given poor performance from an application point of view, due to the mica flakes delaminating during bending around the conductors or coils. For layer insulation in transformers, where the material is used in sheet form, the heavier thicknesses perform satisfactorily because they are not subjected to bending. In application where the material is to be used as a tape wrapped around a small diameter the thinner tapes give better performance.

* * *

IN the manufacture of glass-mica tape and sheets, mica splittings approximately .002" in thickness are silicone bonded to glass fabrics in widths of 36". This operation is done on a continuous basis so that long length rolls are obtained without splices. The material so bonded is then subjected to a special coating process developed by Irvington Varnish and Insulator Company which increases both the flexibility and bond of the mica

TABLE III

Electrical and Physical Properties Silicone Glass-Mica

Thickness	.006" ± .001"
Approximate Weight—lbs. per sq. yd.	0.396
Tensile Strength—Warp	90 pounds
Fill	60 pounds
Dielectric Strength—¼" electrodes	
Minimum	400 V.P.M.
Maximum	1100 V.P.M.
Average	600 V.P.M.

TABLE IV

Electrical and Physical Properties Silicone Rubber Coated Fiberglas

Thickness	.007"	.010"	.012"	.015"
Wt/Sq. Yd.	0.60	0.90	1.07	1.31
Tensile Strength P.I.W.	100/85	160/150	225/195	225/195
Volt/Mil. 25°C—¼" electrodes	800	700	600	500
Power Factor 25°C	0.7%	0.7%	0.7%	0.7%
Dielectric Constant 25°C	3.20	3.25	3.20	3.20
Low Temperature flexibility	—70°F	—70°F	—70°F	—70°F

Heat Resistance: The silicone rubber coated fiberglas will retain its flexibility after 1000 hours exposure to 250°C.

flakes. The material can then be slit to any desired widths of tape and supplied in 200 to 250 yard rolls for continuous taping operations.

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THE outstanding properties of this glass-mica is its exceedingly high heat and flame-resistance. Even at temperatures which will decompose the silicone resins (above 250°C) this mica will remain intact and act as a physical barrier preventing short circuits. Cables made with glass mica as an integral part of the insulation will withstand direct flame for long periods of time without failure. Typical tests results on a .006"—.007" Glass-Mica Tape are shown in Table III. (See page 297.)

★ ★ ★

Silicone Rubber Coated Fiberglas Cloth

SILICONE Rubber Coated Fiberglass consists of fiberglas cloth which has been impregnated and coated to the desired thickness by special coating techniques and cured at temperatures of 650°F and higher. The resultant product is very flexible and lends itself to ease of application to all types of electrical apparatus. The cured silicone rubber is a tough rubbery material having as its outstanding properties high heat-resistance and good electrical properties. Whereas ordinary rubber will become stiff and crack on exposure to 125°C, the silicone rubber will maintain its flexibility without cracking at temperatures of 200°C for long periods of time. The electrical and physical properties of this material are shown in Table IV for a range of thicknesses. (See page 297.)

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SINCE these materials are operated at elevated temperatures, it is of interest to examine more closely the electrical properties at elevated temperatures. Figure 3 shows the power factor temperature relationship of silicone rubber coated fiberglas and Figure 4 shows the variation of dielectric strength with temperature.

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EXAMINATION of these curves shows that there is a slight increase of power factor with temperature and that the dielectric strength remains almost constant with increasing temperature. This behavior is of considerable importance in designing equipment because it means the performance of this equipment at elevated temperature will be similar to that at room temperature.

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Special Silastic Rubber Coated Fiberglas R-12 and R-20

THE most recent development in the line of silicone insulations is a vulcanizable Silastic Rubber which can be cured in the same manner as regular rubber insulation. This material is processed by standard equipment and after curing according to instructions

(*Please turn to page* 326)

FIGURE 3

POWER FACTOR VS. TEMPERATURE
SILICONE RUBBER COATED FIBERGLASS

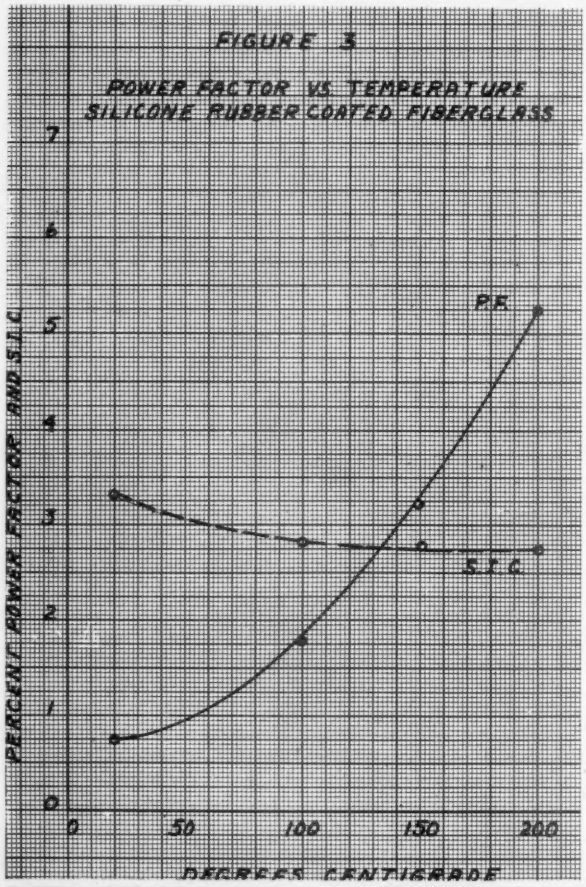
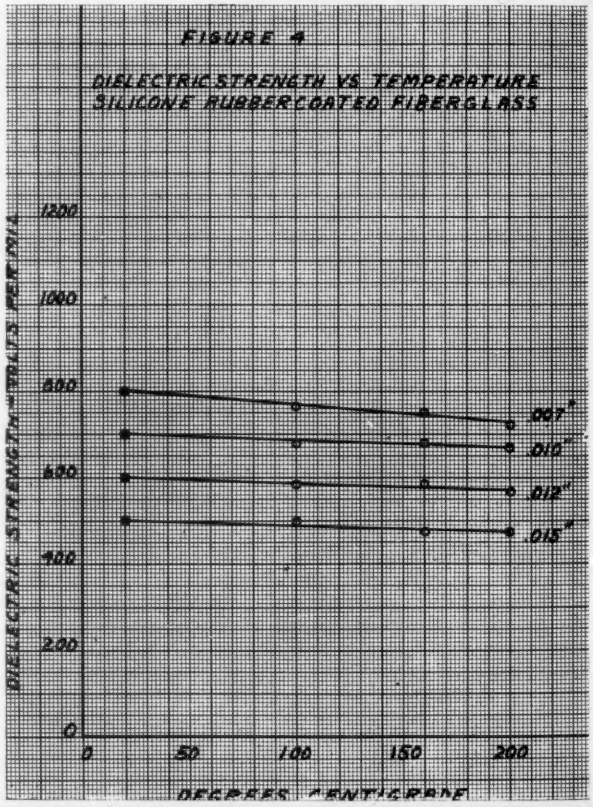


FIGURE 4

DIELECTRIC STRENGTH VS. TEMPERATURE
SILICONE RUBBER COATED FIBERGLASS



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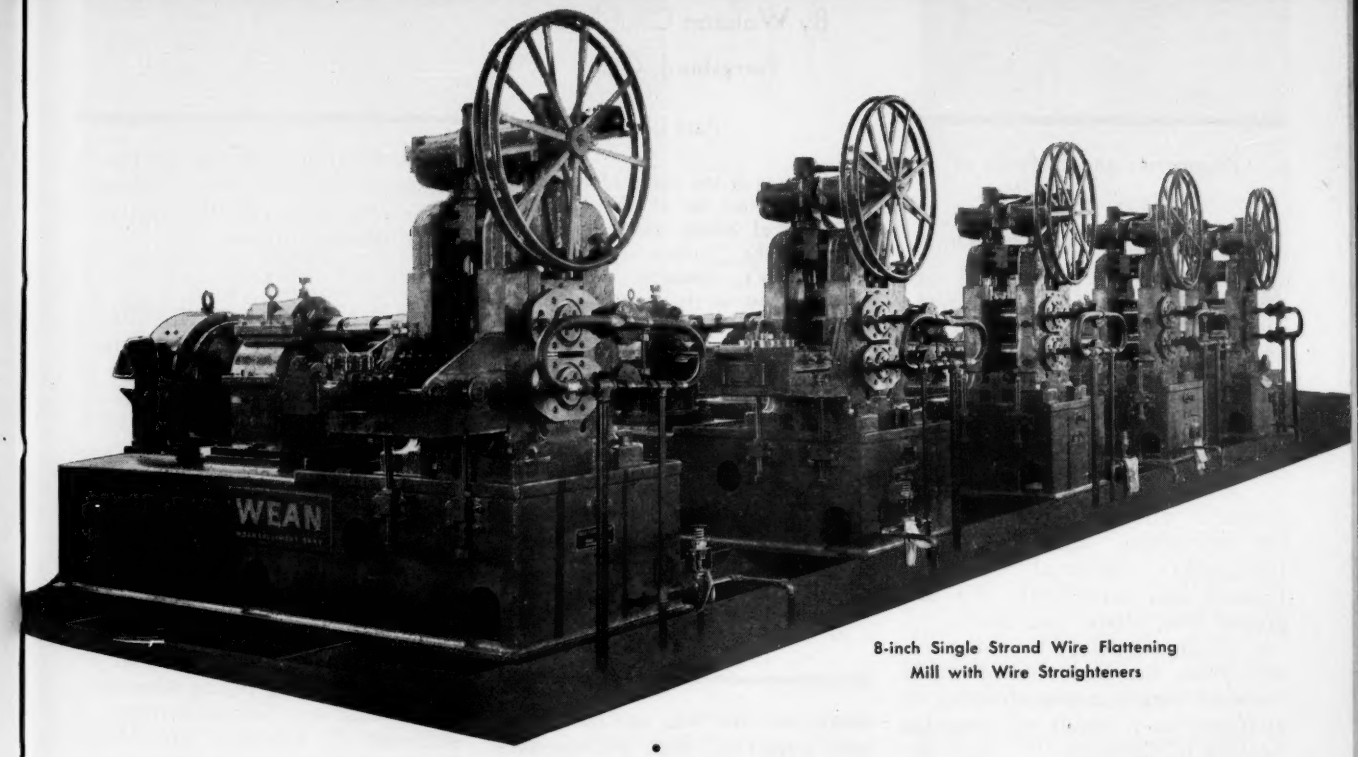

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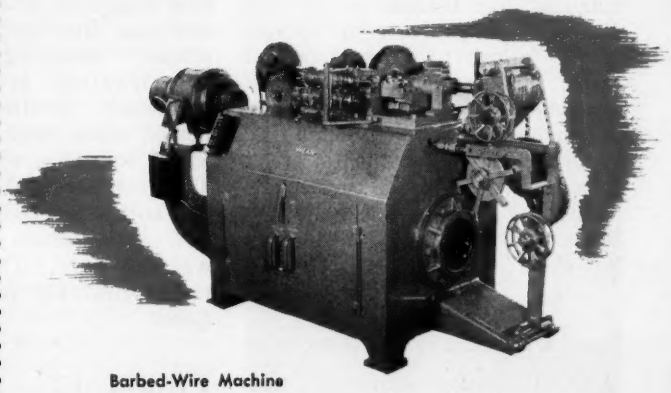
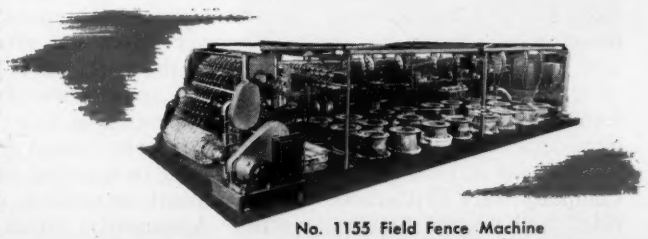


Barbed-Wire Machine



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An Investigation Of The Weavability Of Wire With Observations On The Defects Of Wire And Wire Cloth

By Walston Chubb, Jr.

Perrysburg, Ohio

Part III

This study is the result of research work carried on at the Missouri School of Mines and Metallurgy under the Ludlow-Saylor Wire Company's research fellowship there, now in its third year. The object of the fellowship is to enable suppliers to furnish better wire and wire cloth buyers to secure the highest quality of product. The first fellow was C. W. F. Funk, whose work is referred to by the author and from whose researches he benefited. The work was carried on under the direction of Dr. E. S. Epplesheimer, professor of Metallurgical Engineering, co-author of the paper. This paper is being published in four installments of which this is the third part.

Properties and Defects of Weaving Wire

Summary of Defects of Wire

ACCORDING to Camp and Francis, the most common defects of steel ingots are segregation, pipe, cracks, blowholes, scabs, columnar structure, and slag inclusions, [34]. Additional defects that may appear in billets and rods are seams, laps, slivers, and fins, [1]. Additional defects that may appear in wire are improper physical properties, internal defects (cuppiness), external fractures (checks and scratches), and improper size, shape and finish, [1]. An additional defect that may result from the heat treatment of finished wire is non-uniformity of stiffness as a result of irregular heating of the wire, [11]. Much defective wire is rejected by the wire manufacturer because of its failure to draw properly or because of its failure to pass inspection tests; but the author has seen practically all of the above defects in finished steel wire at some time or other. Many of these defects were discussed in a thesis presented at the Missouri School of Mines and Metallurgy in 1948 by Mr. C. W. F. Funk, [17].

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Special Defects of Weaving Wire

ACCORDING to workers at Ludlow-Saylor Wire Company, almost all wire defects have caused more or less trouble in wire weaving, but fortunately very few of the defects appear often. The most common defects of weaving wire noticed by the author in his experiences at Ludlow-Saylor Wire Company were brittleness, uneven color, and uneven temper or stiffness. Brittleness caused weaving wire to break during the crimping operation, and was the most common defect of high carbon steel wire noticed by the author. Brittleness might be caused by improper analysis, improper pickling, improper patenting, segregation, "overdrawing," or some mechanical defect. Brittleness of fine annealed wires might be the result of die scratches which greatly reduce the strength of such wire. The author has no definite information on the causes of brittleness in weaving wire. This should be a fertile field for future investigations.

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UNEVENLY colored weaving wire resulted in cloth that had a patchwork appearance. This did not affect the mechanical quality of the cloth, but it did detract from the appearance of the cloth. Discoloration of bright annealed wire has been traced to the lubricants used in drawing and to the subsequent annealing of these wires. Apparently small differences in temperature cause great color changes in certain lubricants, [25]. Slight differences in the degree of oxidation of steel wire will also cause large color variations in blue-black annealed wire.

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NON-UNIFORMITY of stiffness of annealed wire was the most frequent and most troublesome of all weaving wire defects encountered by the author. Non-uniform wire seemed to be very difficult to weave and when woven often resulted in bumpy cloth, uneven mesh, knots, tears, uneven selvage, or broken wires. "Spotty wire" will lower the quality of the cloth produced, and because of the extra time and handling and scrapped cloth involved, such wire will always prove costly to the wire cloth manufacturer. Non-uniformity of stiffness of annealed steel wire has been found to be caused primarily by two different defects of wire: improper annealing and segregation. The discovery of non-uniform annealing of steel wire was reported in 1942 by Mr. L. D. Granger, [11]. And in the discussion of his paper it was reported that this non-uniformity in annealing was caused by part of the wire being exposed to radiant heat while another part received no radiant heat. To overcome this effect "bell type annealing" was substituted for "pot type annealing," [25].

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Non-uniform Annealing

THE author has investigated a number of cases of wire that has failed to weave properly because of improper annealing, and these cases will be discussed in detail. It should be pointed out that these samples of wire were investigated primarily by means of the transverse-crimp-sensitivity

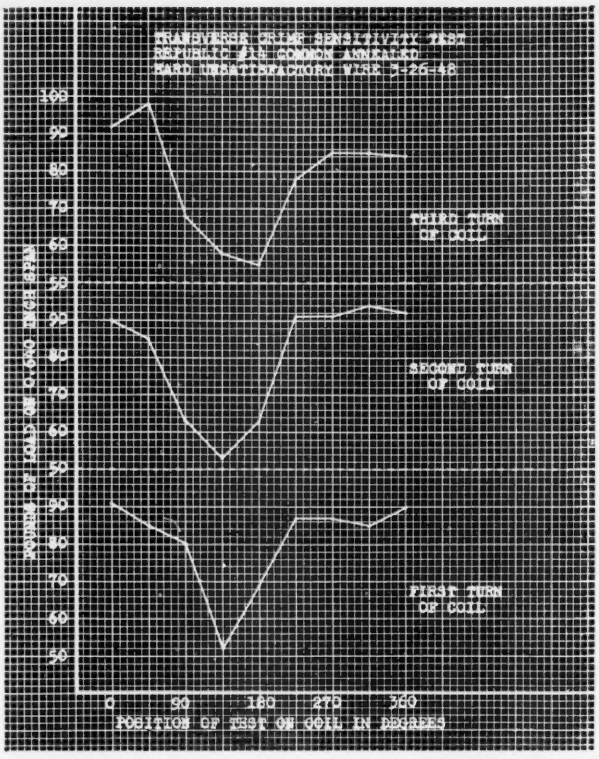

Figure 8: Graph showing the results of 25 transverse-crimp - sensitivity tests run on poorly annealed, Republic, 14 gage, common annealed wire * *

test at the same time that the test was being developed.

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THE first sample investigated was part of a coil of common annealed, 14 gage, Republic (3-26-48) wire. The loom operator using this wire complained that it was "extra hard" and that when used as fill wire on a shuttle type loom, it left large loops of wire in the selvage and caused the warp wires to crimp more deeply than the fill wires. This effect produces bumpy cloth.

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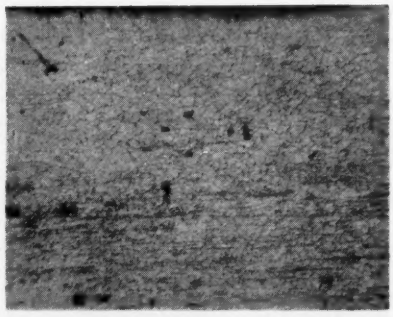

Figure 10: Specimen taken from the soft side of a coil of Republic, 14 gage, common annealed wire. Longitudinal section. 100x. The photograph shows a considerable area of complete recrystallization, but some orientation remains at the center of the wire. Nitol etch. Knoop hardness of outer portion: 140. * * *

THE part of the coil taken as a sample was marked off into quadrants, and test specimens were taken successively from points at every 45 degrees around the coil. These specimens were tested in order by means of the transverse-crimp-sensitivity test, and the end-point loads were recorded. A total of twenty-five tests were run in this manner until three complete turns of the coil had been tested. The results of these tests were plotted in figure 8, which clearly shows how the stiffness of the wire varied in a cyclic manner around the coil. One side of the coil was hard and the other soft. Metallographic specimens were cut from the hard side and the soft side of the coil, and photographs of these specimens appear as figures 9 and 10.

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IN order to prove that the structure of figure 9 was definitely the result of cold working, another specimen from the hard side of the coil was taken and heated to 1400 degrees Fahrenheit for a few minutes. It was then mounted and its photograph appears as figure 11. This evidence proves that the wire

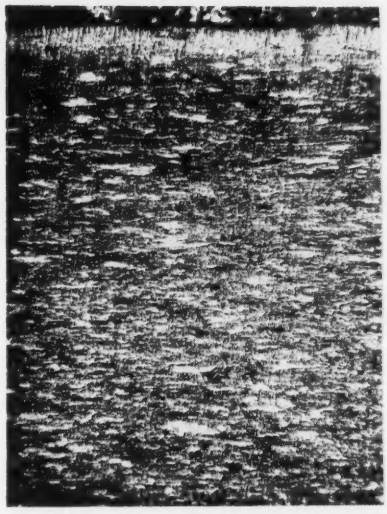

Figure 9: Specimen taken from the hard side of a coil of Republic, 14 gage, common annealed wire. Longitudinal section. 100x. The photograph shows a degree of orientation that results only from extreme cold working. The effects of annealing are not apparent even at the surface of the wire. Nitol etch. Knoop hardness: 218.

was improperly annealed and indicates how the wire produced large loops in the selvage during weaving operations; whenever the shuttle reversed directions, the wire bent occasionally at a soft point instead of next to the cloth.

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THE second sample investigated was part of a coil of 16 gage, Keystone (2-14-48), common annealed wire. This coil was one of a large lot of wire about which the weavers complained that one bun-

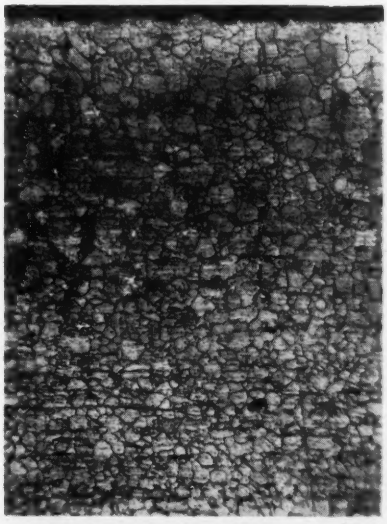


Figure 11: Specimen taken from the hard side of a coil of Republic, 14 gage, common annealed wire and re-annealed at 1400 degrees Fahrenheit. Longitudinal section. 100x. This photograph shows the treated wire to be completely recrystallized. Nitol etch. Knoop hardness: 142.

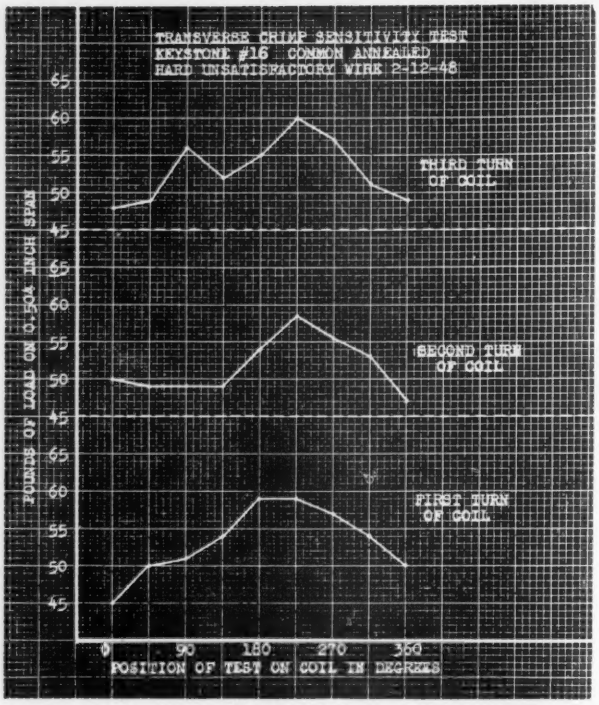
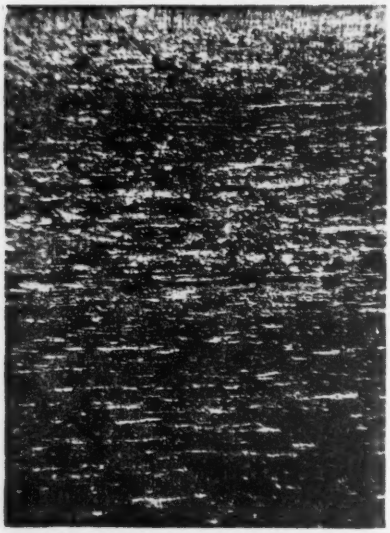


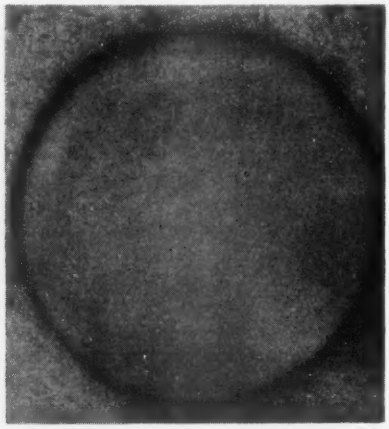
Figure 12: Graph showing the results of 25 transverse-crimp - sensitivity tests on poorly annealed, Keystone, 16 gage, common annealed wire. * *

dle was "hard" and the next bundle "soft." The sample selected was part of a "hard" bundle. This hard wire was too "hard" to be used on the bobbin for the fill, but it could be used in the warp. When used in the warp, the hard wire caused the softer fill wires to be crimped much more deeply than it was. This results in bumpy cloth, and the fact that the hard wire could not be used in the fill caused the weaver to spend considerable time in selecting coils for use as fill wire.



* * *

THE coil selected as a sample was marked off into quadrants and, as before, specimens were cut out successively from points every 45 degrees around the coil. These specimens were tested by means of the transverse-crimp-sensitivity test and the results were plotted in figure 12. Evidently, this coil was cyclic also, much like the first coil investigated. Evidently, the "hardness" of this wire was also the result of poor annealing; and evidently, the "soft" spots were regions that had received more heat than the "hard" spots. In order to check these observations, metallographic specimens were cut from the "hard" side and from the "soft" side of the coil, and photographs of these specimens appear as figures 13, 14, 15, 16, 17 and 18. The photographs show that much more recrystallization and softening have taken place on one side of the coil than on the other, but the extraordinary condition appearing in figures 15, 16, 17, and 18 demanded further investigation. Since the heat causing recrystallization must have traveled from the surface of the wire and must have passed through the dark bands to cause recrystallization in the light bands, it follows that there is something unusual about the dark bands that hindered recrystallization.



Figures 13 and 14: Longitudinal section, 150x, and cross section, 50x, of a specimen taken from the hard side of a coil of 16 gage, Keystone, common annealed wire. The photographs show that almost no recrystallization has taken place on this side of the coil as a result of the annealing operation. Nitol etch. Knoop hardness: 235. * * * * * *

* * *

IT was found that the structure of figure 17 existed throughout the coil, at least on the soft side of the coil. Thereupon, a specimen was cut from the hard side of the coil and this specimen was annealed at 1400 degrees Fahrenheit to remove the cold work structure of figures 13 and 14. This annealed specimen was mounted and its photographs appear as figures 19, 20, and 21. These photographs show that complete recrystallization has taken place in the reannealed specimen, but that the grains are much smaller in the dark areas than in the light areas. This is the same cored structure that was detected on the "soft" side of the coil, and the fact that it is present throughout the coil and the fact that it persists through the annealing suggest that the cored structure is the result of segregation. Segregation refers to the concentration of alloying elements in one part of a piece of metal. In steel, the concentration of certain elements in one area can greatly hinder the growth of the ferrite grains in that area during recrystallization. A chemical analysis showed that this wire contained the foreign elements nickel and copper (0.07 percent of nickel and 0.33 percent of copper).

* * *

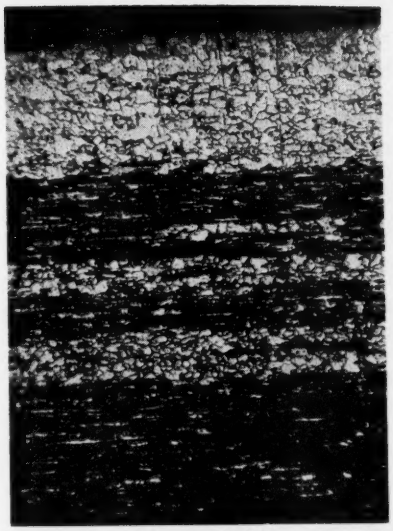
THE fact that the cold-work structure of figures 13 and 14 can be removed by annealing and the fact that segregation in this wire occurs on all sides of the coil, proves that the non-uniformity of stiffness of this wire was caused by insufficient annealing. However, it may be that the segregated condition of this wire contributed to its hardness and may have hindered the proper annealing of the wire.

★ ★ ★

THE third sample investigated was a piece of 13 gage, Keystone, common annealed wire. This sample was received from Ludlow-Saylor in December, 1948, and was described as "hard" wire. The sample was straightened and rewound into a coil approximately twenty-six inches in diameter. Then one complete turn of this coil was examined by means of the transverse-crimp-sensitivity test. The average end-point load for eight tests performed at regular intervals around this turn was 134 pounds. A high value of 143 pounds was found, and a low value of 112 pounds was found. The transverse-crimp-sensitivity of satisfactory, 13 gage, common annealed wire is only about 92 pounds and variations from this value of greater than ten percent are believed to be sufficient to make the wire unsuitable for the production of uniform cloth. The softest point in this particular sample of wire was 22 percent stiffer than satisfactory wire, and the sample showed variations within itself of 16 percent.

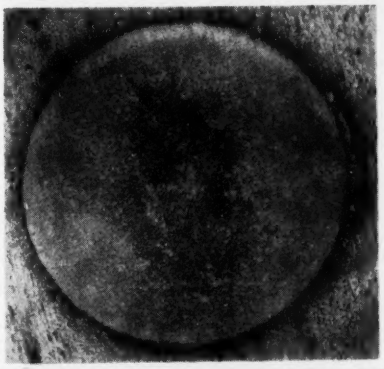
★ ★ ★

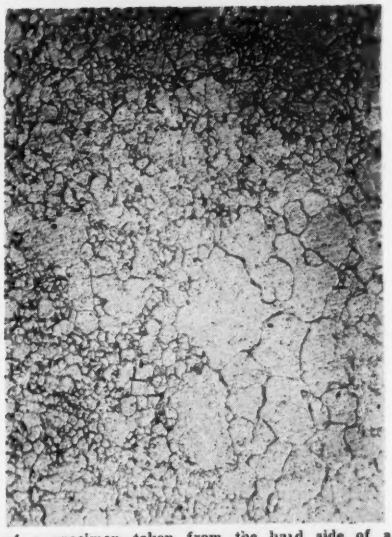
APPROXIMATELY the same readings of crimp-sensitivity were obtained at the beginning and at the end of the turn of wire that was tested and, therefore, it was believed that the coil from which this wire was taken was cyclic in nature, and that the unusual hardness of the wire was the result of faulty heat treatment. To confirm these beliefs, two metallographic specimens were made up from the remnants of the transverse-crimp-sensitivity test specimens; one specimen from the test that indicated the greatest stiffness, and



Figures 15 and 16: Longitudinal section, 150x and 750x, of a specimen taken from the soft side of a coil of 16 gage, Keystone, common annealed wire. The photographs show that this side of the coil has been partly recrystallized by the annealing operation. The banding of the areas of recrystallization is most extraordinary and the author cannot adequately explain it. Nitol etch. Knoop hardness: 224 (above).

Figures 17 and 18: Cross section, 50x and 750x, of the specimen taken from the soft side of a coil of 16 gage, Keystone, common annealed wire. This is the same specimen as shown in figures 15 and 16. The dark areas are the regions where recrystallization has not taken place. Figure 18 shows the outer dark band of figure 17 at high magnification. Nitol etch. Knoop hardness of center portion: 224 (above).





Figures 19 and 20: Cross section, 50x and 750x of a specimen taken from the hard side of a coil of 16 gage, Keystone, common annealed wire and re-annealed at 1400 degrees Fahrenheit. These photographs show that complete recrystallization has taken place, but that some condition such as segregation has prevented grain growth in certain areas. Figure 20 shows the edge of the dark area of figure 19 at high magnification. Nitol etch. Knoop hardness of center portion: 162.

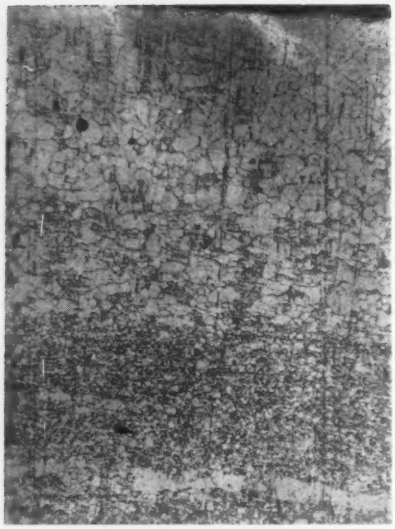


Figure 21: Longitudinal section, 150x, of a specimen taken from the hard side of a coil of 16 gage, Keystone, common annealed wire and reannealed at 1400 degrees Fahrenheit. This is the same specimen as shown in figures 19 and 20. This photograph shows that complete recrystallization has taken place, but shows that almost the same arrangement of bands remains as appeared in figure 15. This condition suggests the presence of segregation. Nitol etch. Knoop hardness of fine grained area: 162. * *

one from the test that indicated the least stiffness. Photographs of these two specimens appear as figures 22 and 23. These photographs prove that this sample was incompletely annealed.

THE fourth case for discussion consisted of two coils of 18 gage, Keystone (6-2-48), common annealed wire. The weaver using this wire complained that some of the wire was weak and that some of it was strong. The weak wire when used in the warp sometimes broke in the cloth near the weaving line and pulled out. Naturally the loom would have to be shut down until the broken warp wire was replaced. Samples of the weak, "light" wire and of the strong, "dark" wire were obtained.

* * *

TRANSVERSE-crimp-sensitivity tests were run, as before, on three turns of each of these coils of wire, and the results are shown in figure 24. Since these data are plotted to the same scale for both coils, it was apparent that the strong, "dark" wire was definitely cyclic and probably poorly annealed, while the weak, "light" wire was nearly uniform. Metallographic specimens were cut from the strong, "dark" wire sample at a soft point and at a hard point, and photographs of these two specimens appear as figures 25 and 26. These photographs prove that the strong, "dark" wire was irregularly and incompletely annealed.

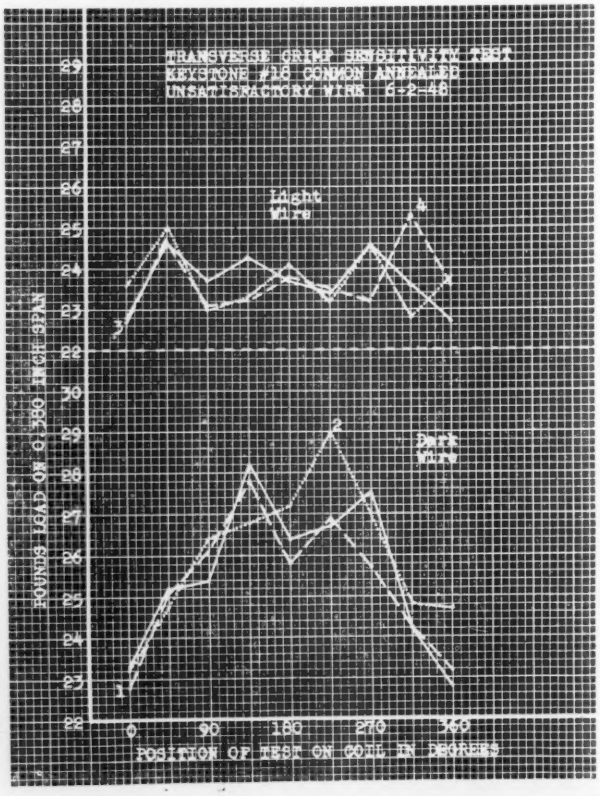


Figure 24: Graph of the results of 50 transverse - crimp-sensitivity tests on two coils of 18 gage, Keystone, common annealed wire. The "light" wire was weak and soft, but uniform. The "dark" wire was strong, but non-uniform. * *

Figure 22: Longitudinal section, 150x, of a specimen taken from the hardest point in a sample of 13 gage, Keystone, common annealed wire. The photograph shows only about one quarter of the section of the wire. It shows that the wire has not been as severely cold worked as most wire is before annealing, and it shows that practically no recrystallization has taken place as a result of the annealing operation. Nitol etch. Knoop hardness: 212. * * *

* * *

HOWEVER, in the examination of the metallographic specimens an indication of segregation in this wire was observed. In order to demonstrate the presence of segregation, specimens of both "light" and "dark" wire were reannealed at 1400 degrees Fahrenheit to remove the signs of cold working that obscured the signs of segregation. When these annealed specimens were examined, it was seen that both the "light" sample and the "dark" sample showed signs of segregation. Figure 27 shows one of these specimens in cross section. The very small grains at the center and the comparatively large grains at the surface of this wire are good indications that some of the alloying elements in this steel have segregated to the center of the wire and

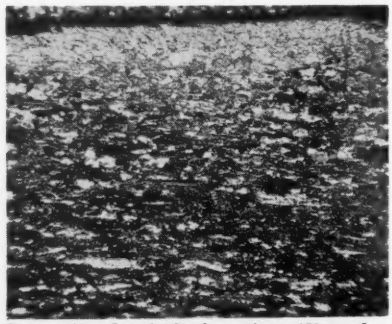


Figure 23: Longitudinal section, 150x, of a specimen taken from the softest point in a sample of 13 gage, Keystone, common annealed wire. The photograph shows only about one quarter of the section of the wire. It shows that only a minor amount of recrystallization has taken place. Nitol etch. The outer portion of this specimen had a Knoop hardness of 158 while the center had a Knoop hardness of 200.

have hindered grain growth there. A chemical analysis of this wire showed the presence of 0.36 percent copper and 0.14 percent nickel. However, since both coils of wire showed this segregation, the fact remains that the poor annealing of one sample was probably the cause of the weaving troubles experienced with this wire.

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THE fifth case for discussion consisted of two coils of 22 gage, bright annealed wire. Both samples were undoubtedly Ludlow Specifications weaving wire. One sample was labeled "Bad, Wickwire," and the other was labeled "Bad, American, will not hold mesh."

★ ★ ★

A NUMBER of tensile tests were run on a coil of good 22 gage, and then three tests were run on each of the bad coils. The averages obtained from these tests were as shown in table.

★ ★ ★

FROM a comparison of these results it is apparent that the Wickwire is stronger and more brittle than the other two. This was the first indication that the Wickwire was "hard" and incompletely annealed. Later it was found that the American wire had been tested in a section that was comparatively soft and a subsequent test was run on the American wire in a somewhat harder section. The results of this test were:

Yield Point	Max. Tensile Strength	Percent Elongation
24.5 lbs.	32.5 lbs.	30%

★ ★ ★

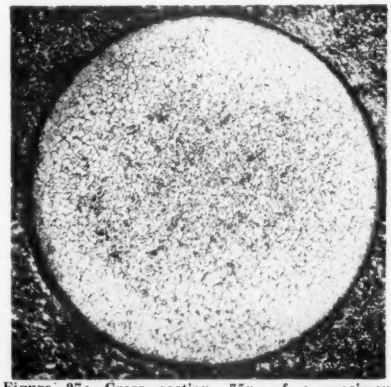
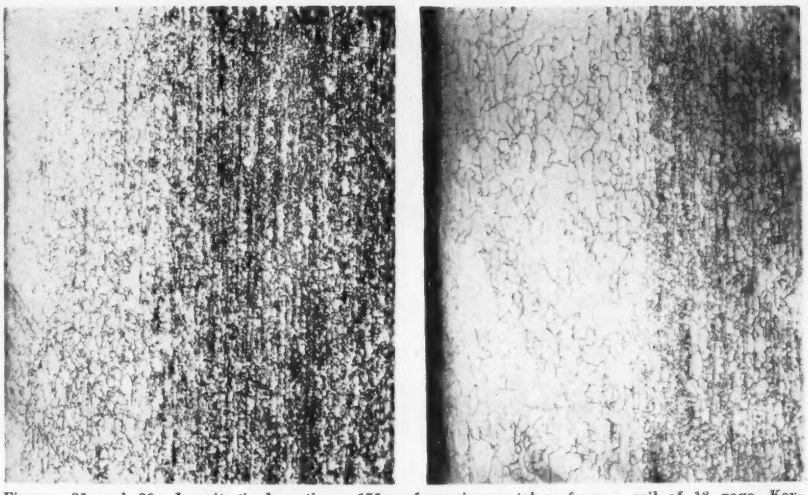


Figure 27: Cross section, 75x, of a specimen taken from a coil of 18 gage, Keystone, common annealed wire and re-annealed. This specimen shows how grain growth has been hindered at the center of the wire, probably by segregation of nickel. Nitol etch.



Figures 25 and 26: Longitudinal sections, 175x, of specimens taken from a coil of 18 gage, Keystone, common annealed wire. Figure 25, on the left, shows a specimen taken from a hard spot in the "dark" coil; and figure 26, on the right, shows a specimen taken from a soft spot in the same coil. It is obvious that more recrystallization has taken place in the soft specimen. Nitol etch.

THE difference between these values and the former apparently is enough to cause trouble in weaving operations, but it would hardly be noticed in a series of routine tests.

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A NUMBER of transverse-crimp-sensitivity tests on the coil of good, 22 gage wire gave an end-point load of 5.73 pounds. Even this good wire was somewhat cyclic, but the deviation from the mean was only four percent. A large number of tests on the bad Wickwire produced an average end-point load of 7.90 pounds. This is 38 percent higher than that of the good wire. The wire was also

TABLE OF TEST AVERAGES

Wire	Yield Point	Max. Tensile Strength	Percent Elongation
Good	19.1 lbs.	28.1 lbs.	31%
American	20.0 lbs.	28.6 lbs.	34%
Wickwire	29.5 lbs.	35.5 lbs.	20%

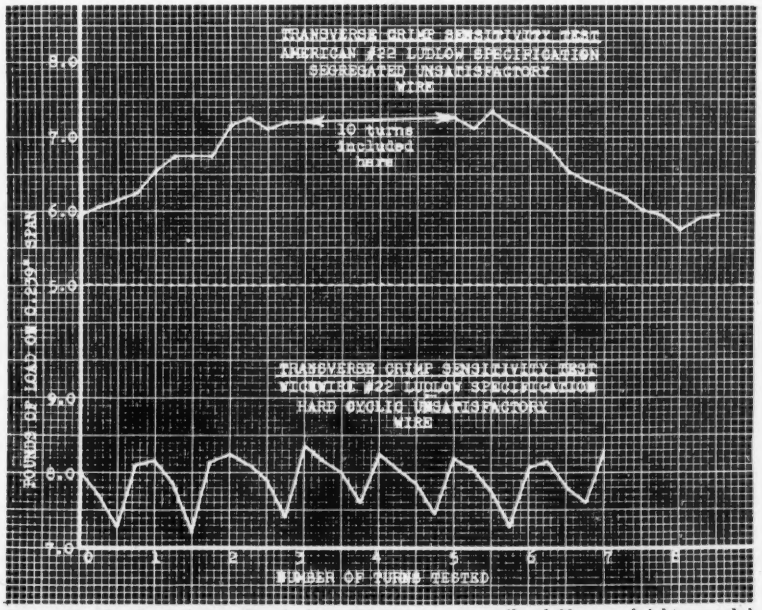

Figure 28: Graph of the results of about 100 tests on two coils of 22 gage, bright annealed wire. The American wire shows a cycle of strength over many turns, while the Wickwire shows a cycle for every turn of the coil.

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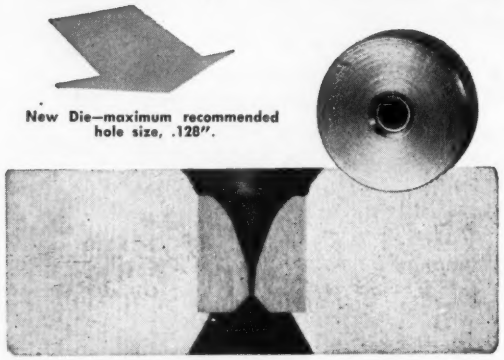

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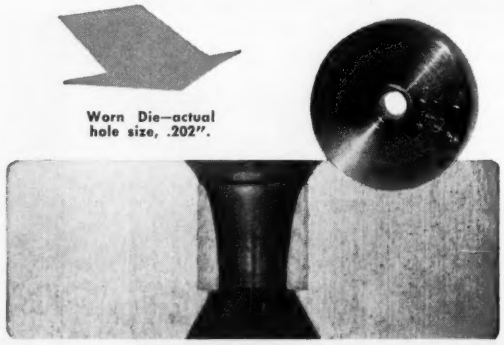

Worn Die—actual hole size, .202".

Proof positive of *performance plus* is recorded in this unretouched photo, enlarged two times, of an R2 die after use on job. It has been refinished until, in this picture, its hole size is .202", almost *twice the recommended maximum.* How's that for performance?

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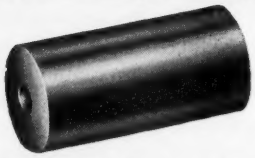

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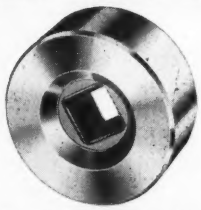

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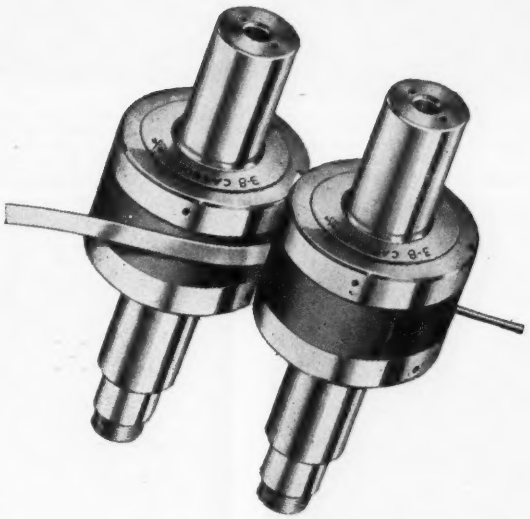

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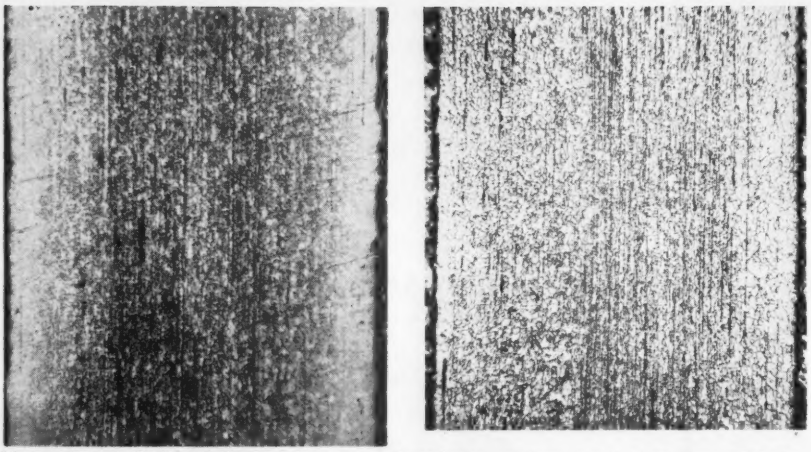
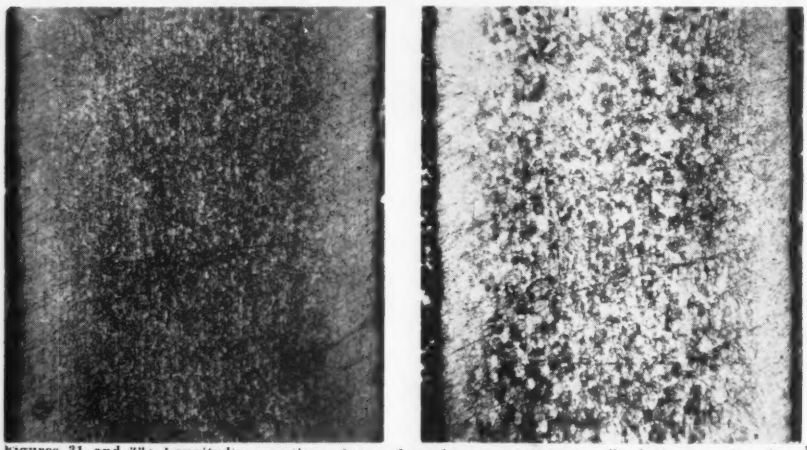
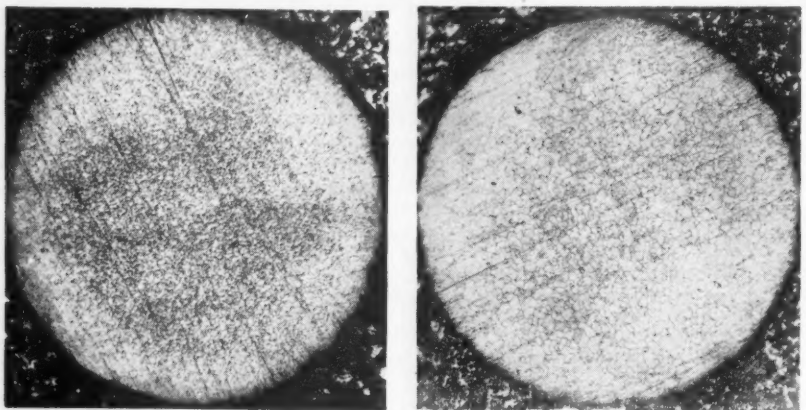


Figures 29 and 30: Longitudinal sections, 100x, of specimens cut from a coil of 22 gage, Wickwire, Ludlow specifications, bright annealed wire. Figure 29 shows a specimen cut from a hard spot in the coil; Knoop hardness: 169. Figure 30 shows a specimen cut from a soft spot in the coil; Knoop hardness: 150. The fragmentary grains and dark bands appearing in these pictures are typical of wire that has been poorly annealed.



Figures 31 and 32: Longitudinal sections, 100x, of specimens cut from a coil of 22 gage, American, Ludlow specifications, bright annealed wire. Figure 31 shows a specimen cut from a hard spot in the coil; Knoop hardness: 141. Figure 32 shows a specimen cut from a soft spot in the coil; Knoop hardness: 118. The small grain size and absence of dark bands of figure 31 seem to indicate that segregation is the cause of the non-uniformity of this wire. Nitol etch.



Figures 33 and 34: Cross sections, 100x, of specimens cut from a coil of 22 gage, American, Ludlow specifications, bright annealed wire. These are the same specimens as those shown in figures 31 and 32. Figure 33 shows a specimen cut from a hard spot in the coil; Knoop hardness: 141. Figure 34 shows a specimen cut from a soft spot in the coil; Knoop hardness: 118. The small grain size and shaded appearance of figure 33 seems to indicate segregation. Nitol etch.

noticeably cyclic and the deviation from the mean was 6.5 percent. The hardness of this wire was probably the major cause of its unsatisfactory performance but the cyclic nature of the wire undoubtedly was a contributing factor. A large number of tests on the bad American wire gave an average end-point load of 6.72 pounds. This is 17 percent higher than that of the good wire. The wire was not at all cyclic but showed a gradual rise and fall of test values over a great number of tests. The deviation of these values from the mean was about 14 percent. This deviation is most certainly the primary cause of the unsatisfactory performance of this wire. It is not difficult to imagine why such a wire would not "hold its mesh." For comparison purposes the results of the crimp tests on the Wickwire and on the American wire have been plotted in figure 28.

★ ★ ★

METALLOGRAPHIC specimens were made up as usual from the hardest and softest spots in both coils. Photographs of these specimens are shown in figures 29, 30, 31, and 32. These photographs prove that incomplete annealing was the cause of the cyclic nature of the Wickwire, bright annealed wire. The small grain size and absence of dark bands in figure 31 seems to indicate that segregation was the cause of the non-uniformity of the American, bright annealed wire. Since segregation usually shows up better in a cross-sectional view, the photographs shown in figures 33 and 34 were taken of the specimens of American wire. These photographs seem to confirm the presence of segregation in the American wire, but a chemical analysis showed the presence of only 0.05 percent of nickel and only traces of phosphorus, chromium, copper, vanadium, and tin. Manganese was present as specified. This wire seemed to have all the characteristics of segregated steel except that the segregating elements were not to be found.

★ ★ ★

IN view of these facts, a sample of the American wire showing the small grains was carefully annealed, and the annealed wire was examined under the microscope. The grain size difference between the inner and outer portions of the wire was almost completely eliminated, giving the appearance of figure 34, but in view of the other properties of this wire, this behav-

ior during annealing does not explain how the grain size difference originated. If the wire had been poorly annealed at its present coil size just before shipment, then it would show peaks of strength in every turn of the coil; it would be cyclic. Instead it shows peaks of strength about every 27th turn.

* * *

THE unusual structure of this 22 gage wire has the following possible explanation: Either small amounts of nickel and oxygen have segregated to the center of the wire in certain areas and have hindered grain growth at a somewhat low annealing temperature. Or, more likely, the wire was improperly annealed as 12 or 13 gage wire before it was drawn to its final size. It is possible for the bad effects of a previous anneal to persist through a subsequent anneal if the second anneal is not precisely controlled so as to remove those effects. Such a case was reported in the discussion of L. D. Granger's article, [25]. There seem to be no other explanations for the unsatisfactory structure of this American, bright annealed wire.

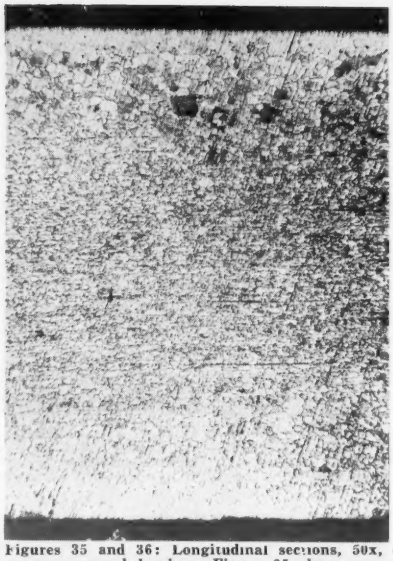
* * *

THE sixth case for discussion was a sample of 14 gage, Republic (7-30-47), common annealed wire that was labeled "hard and soft." The transverse-crimp-sensitivity test immediately showed that the wire was cyclic; hard on one side of the coil and soft on the other. Figure 35 shows a metallographic specimen from the hard side of the coil, and figure 36 shows a specimen from the soft side of the coil. It is apparent that this wire has not been thoroughly annealed. Probably it was not held long enough at the annealing temperature.

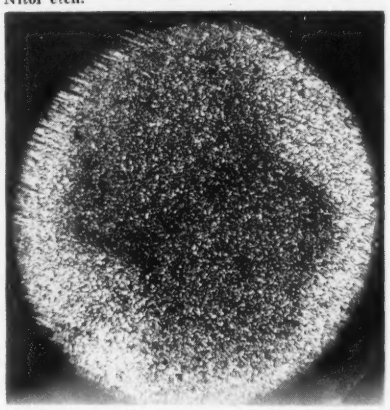
* * *

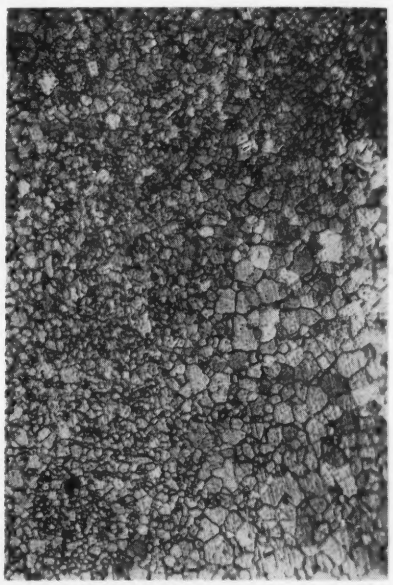
Segregation

THE six cases discussed thus far have been examples of wire that failed to weave properly because of non-uniformities caused primarily by incomplete annealing. The next two cases to be discussed are examples of wire that the author found to be non-uniform because of segregation.



Figures 35 and 36: Longitudinal sections, 50x, of specimens cut from a coil of 14 gage, Republic, common annealed wire. Figure 35 shows a specimen cut from the hard side of the coil; Knoop hardness: 152. Figure 36 shows a specimen cut from the soft side of the coil; Knoop hardness: 122. A few dark bands may be seen in figure 35 indicating that the wire was not thoroughly annealed. Nitol etch.





Figures 37 and 38: Cross section, 75x and 500x, of a specimen of 17 gage, Keystone, common annealed wire taken from one of the samples of unsatisfactorily crimped wire. Figure 38 shows the interface between the fine grained area and the coarse grained area at high magnification. The fine grained area had a Knoop hardness of 227, while the coarse grained area had a Knoop hardness of 198. This condition is undoubtedly produced mainly by segregation.

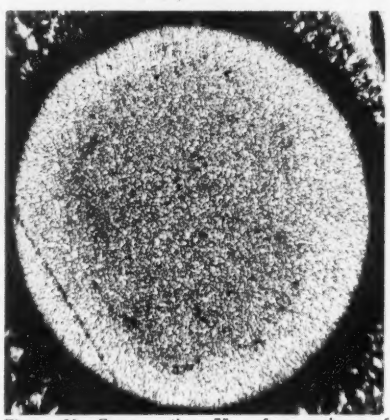
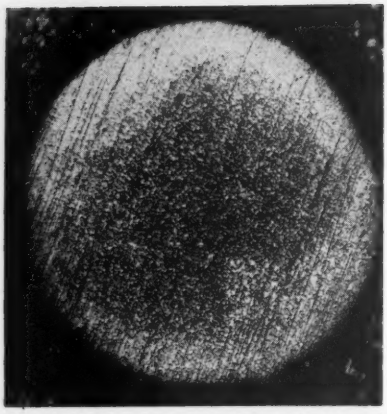
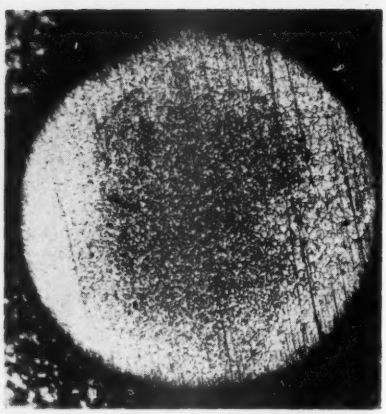


Figure 39: Cross section, 75x, of a specimen of 17 gage, Keystone, common annealed wire taken from a very soft portion of the uncrimped sample. The center portion of this specimen had a Knoop hardness of 143.

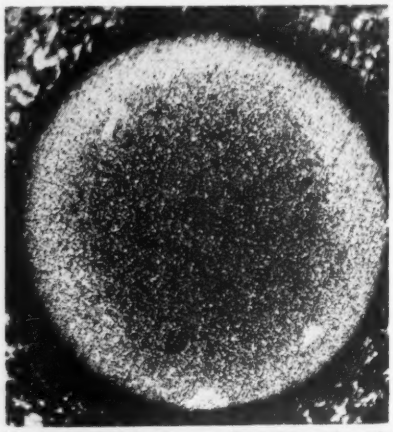
* * *

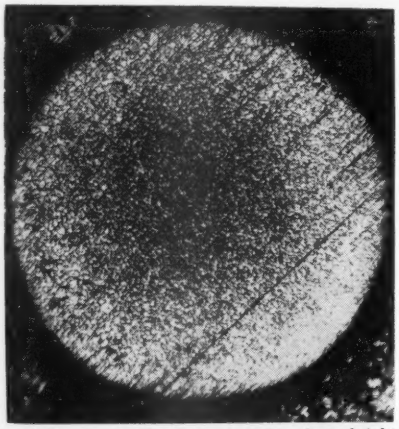
AS explained earlier, segregation refers to the concentration of alloying elements in one section of a piece of steel. The concentration of certain elements, such as nickel and chromium, can greatly hinder the recrystallization and growth of the ferrite grains in the area of concentration. Such elements as nickel, copper, chromium, vanadium, and tin are known as "tramp alloys" in plain carbon steels, and they get into such steels by way of the alloy scrap now finding its way



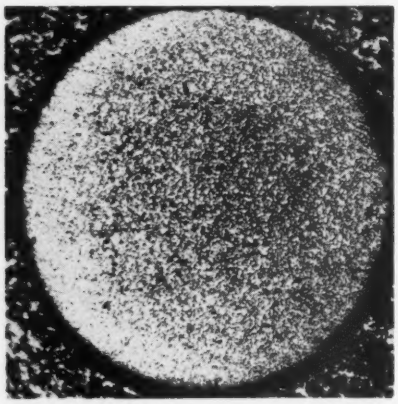


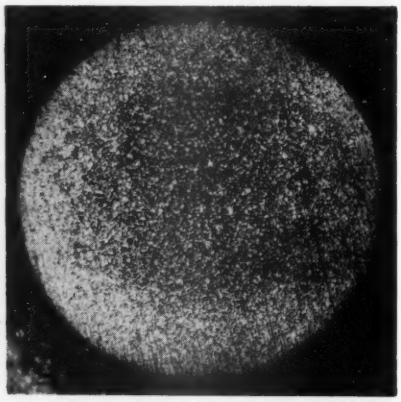
Figures 40 and 41: Cross sections, 100x, of specimens cut from a sample of 21 gage, American, bright annealed wire. The weaver called this "bad dark wire." Figure 40 shows a specimen taken from a "hard" spot in the sample; Knoop hardness: 144. Figure 41 shows a specimen taken from a "soft" spot in the sample; Knoop hardness: 142. These specimens show an irregular, fine-grained area which indicates that the steel is segregated. Nitol etch. * * * * * * *





Figures 42 and 43: Cross sections, 100x, of specimens cut from a sample of 21 gage, American, bright annealed wire. The weaver called this "bad white wire." Figure 42 shows a specimen taken from a "hard" spot in the sample; Knoop hardness of center: 156. Figure 43 shows a specimen taken from a "soft" spot in the sample; Knoop hardness of the center: 142. These specimens show a fine grained area which indicates that the steel is segregated. Nitol etch. * * * * * * *





Figures 44 and 45: Cross sections, 100x, of specimens cut from a sample of 21 gage, American, bright annealed wire. The weaver called this "good white wire." Figure 44 shows a specimen taken from a "hard" spot in the sample; Knoop hardness: 142. Figure 45 shows a specimen taken from a "soft" spot in the sample; Knoop hardness: 135. Note how this "good" wire shows comparatively little difference in grain size as a result of segregation. Nitol etch. * * * * * *

into steel production in ever-increasing amounts. Segregation is usually most severe in the top and center of a steel ingot; and segregation in a steel product can sometimes be traced to insufficient cropping of the ingot from which the steel came, [35].

★ ★ ★

THE seventh case of unsatisfactory weaving wire consisted of a number of samples of 17 gage, Keystone (5-29-48), common annealed wire. This wire was causing considerable trouble to one of the operators of a manually operated, double-crimp loom. When he picked a handful of fill wires out of the rack of his crimping machine and tapped them down into a bundle, he found that some of the wires were considerably longer than the others. Upon comparison of the long wires and the short wires, it became apparent that they all had the same number of crimps; and, since one was longer than the other, the crimps did not register from one fill wire to the next. In other words the short wires had more crimps per yard than the long wires. This, of course, made it difficult for one of these wires to be properly woven into the cloth after the other kind had been woven into the cloth. Either the width of the cloth had to change rapidly or the wire had to bend. This particular operator was culling out the longest of the wires from his bundles; but even so, periodically he would have to bank up his machine and remove a fill wire that had bent and formed a "hickey."

★ ★ ★

EXAMINATION of a sample of the uncrimped wire showed that it was properly annealed. Likewise, samples of the crimped wire, both long and short, appeared to be fully annealed, and therefore annealing was not the source of trouble in this case. Examination of the uncrimped wire by means of the transverse-crimp-sensitivity test showed that the workability of the wire varied erratically from point to point, and that the variations in the wire were not cyclic. The average of 32 tests on one end of the coil gave 28.2 pounds, with a high of 31 pounds and a low of 26.8 pounds. This is within ten percent, and it is believed that all of this particular sample of wire should weave satisfactorily. However, the average of 18 tests on the other end of the coil gave 27.0 pounds, with a high of 28.3 pounds and a low of 25.4 pounds. Again this is within ten percent. But if the overall average of the two ends

(*Please turn to page* 329)

Safety in the Mill

By Philip B. Ray

Manager Industrial Relations,
Titan Metal Manufacturing Company
Bellefonte, Pennsylvania

Successful measures to prevent accidents call for a proper approach and a never-ending vigilance on the part of management. Continuous education and watchfulness over the physical, well-being of employees pays dividends. How Titan has organized to meet their own problems should be helpful to others—all have the problem.

ACCIDENT prevention in the form of an organized safety campaign came into being at Titan in 1936. At that time we had a total of 450 employees. During the year 1935 these 450 plant employees were implicated in a total of 180 lost time accidents and injuries requiring the services of a doctor.

* * *

IT was evident that a safety job had to be done and immediate steps were taken to that end. Since no accurate records were kept, it was impossible to use past experience for any other than comparative purposes.

* * *

THE first move was the appointment of a five-man safety committee. Its primary objective was to reduce accidents. In the beginning the Committee met weekly and analyzed each accident to determine preventive measures and avoid recurrence. Through this analysis the Committee developed some very tangible information. For example, they discovered eye injuries were running on an average of 15 a month. To combat this the Committee recommended to Management that all employees, regardless of their work or occupation, must wear safety glasses while in the plant. This preventive measure was adopted in 1936 and to this day no office employee, visitor or workman can enter any of Titan's five plants without his safety or prescription glasses. As a result, eye injuries have been practically eliminated.

* * *

A FURTHER analysis disclosed that foot injuries were predominant. About the same time as the Committee recommended safety glasses, they decided that only by the adoption of safety-toed work shoes could they hope to reduce or eliminate foot injuries. This presented a slightly different problem, in the case of safety glasses the Company supplied them; however, employees would be expected to purchase their own shoes. To get 100% cooperation, and that was the grounds on which safety shoes were adopted, the Committee had to launch into an educational program. Manufacturers of safety shoes set up show rooms in the plant, and they displayed the different types of work shoes. The Company in turn agreed to purchase these shoes in bulk and give the employees the benefit of the wholesale price plus the fact that the cost could be deducted in installments from their pay check. Through this approach we won employee acceptance and through highlighting the results of our decrease in toe injuries, we were able to gradually transfer the handling of safety shoes from the Company to our local shoe merchants.

* * *

NOW, nearly fifteen years later, the question of safety shoes is never raised. New employees accept safety shoes as a condition of employment and old employees have become so used to wearing them that the matter is rarely discussed.

* * *

IN 1937 we equipped a modern dispensary and engaged the part time services of a physician who had spent many years as Resident Doctor at a State Penitentiary. On his advice we hired a full time industrial nurse who is still with us.

* * *

AN analysis of injuries disclosed the fact that in many cases disability was caused or prolonged by infection. At this point the Committee, with the full backing of Management, established the following hard and fast rule which has been steadily adhered to ever since: "Every injury, no matter how slight, must be treated at the first aid dispensary. Any employee reporting for treatment after infection has set in is subject to penalty."

* * *

NOW we had complete records and adequate facilities. What about the results? The first year under the new set up showed a 50% reduction in lost time accidents.

* * *

ENCOURAGED by the progress we had made, the Committee began to broaden its activities. They prepared and had printed a Company Safety Rules Booklet which was issued to all old and new employees. With careful consideration they chose a full time Safety Inspector from our Maintenance Department who had had previous experience in the field of accident prevention work.

* * *

(*Please turn to page* 340)

Handling Materials in Whitney Blake's Plant

The material for this article has been furnished through the courtesy of the Electric Industrial Truck Association. It is published in the belief that the experience of one mill in cutting materials handling costs will be of interest and value to other mills.

WAREHOUSE space has been fully utilized; movement of material—incoming, in-process and finished product into outward shipment — has been accelerated, and there have been substantial savings both in time and labor in the handling of material at the plant of The Whitney Blake Company, Hamden, Conn., since the Company installed a fork truck-pallet system for the handling and storage of material.

★ ★ ★

IT was in 1944 when the Company, which manufactures shielded cable for electronic devices, in addition to drop wire and portable cords, placed its first storage battery-powered fork truck in operation. During mid-1949 the Company installed its fourth fork truck. All the trucks are of 2,000-lb. capacity, and all are capable of tiering loads to a height of 80 inches.

★ ★ ★

MATERIAL used in the manufacture of its line of wire products arrives—in box-cars or in over-the-road trucks—on reels, in drums, bales, bags and/or sacks. Insofar as possible all material is placed on double-faced, two-way, wooden pallets which are standardized at 48″x48″ in size. Reels of copper wire, each of some 250-lb. weight, are placed eight to a pallet, and these are three- to four-high in the stock area of the Receiving Department. Drums of dry items such as waxes, or of the fillers used in manufacturing the insulation used on the Company's product, also are palletized and stored three-high. Varnishes, lacquers and other liquids, which are received in metal drums, likewise are palletized and tiered several high. Bales of rubber, natural or synthetic, are palletized and handled by the trucks from receipt, into storage, and finally into production. Sacked, or bagged, material, is made into unit loads of from twenty to thirty items, interlocked to prevent shifting or slipping, and these, too, are tiered to within some eighteen inches of the sprinkler lines.

Requisition of raw material for production lines is but a matter of a few minutes at the plant of this manufacturer of drop wire, portable cords, and other items for electrical apparatus, since Company installed a fork truck-pallet system of handling and storing materials. Battery-powered fork trucks move to Stock Area, remove material—(such as reels of copper wire in above picture)—and deliver the same directly to the department where it is needed. System, in operation at the plant since 1944, has proved to be a saver of time, labor, and money, according to Company officials. * * * * *

★ ★ ★

INSOFAR as possible the trucks operate within the cars, taking in empty pallets and removing loaded ones. Safety dock plates bridge the area between the Receiving Room Floor and the freight cars, while overhead safety guards protect the truck's operator from possibility of toppling loads when tiering to extreme heights.

★ ★ ★

WITHIN the receiving room the fork truck operates some nine hours a day, but in the production area of the plant they are operated two shifts, or approximately 16 hours. All trucks are withdrawn from Service for a short interval once a month for greasing, inspection and check-up while the storage batteries—one for each truck, and with spares for battery-change—receive the same servicing. Batteries are changed at a waist-high rack, and trucks are out of service for some five minutes for a change.

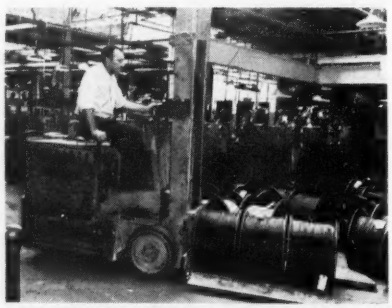
★ ★ ★

THE Company recently made some changes in its Receiving Room so as to permit fully palletizing all items handled there. This change not only permitted conservation of area hitherto given to storage, but also permitted storage of a larger amount of material since all available vertical area is being utilized.

★ ★ ★

GOODS-IN-PROCESS are transported intra-plant, department to department by means of fork trucks. Reels of insulated wire, for instance, are moved from production line to the test department, three at a time, by sliding the truck's forks on each side of the reels which are on edge. Following test, the reels are moved to other departments for the balance of the manufacturing process in the same manner.

(*Please turn to page* 338)



Transporting goods-in-process from one department to the next is done quickly, quietly and efficiently at the plant by means of storage battery-powered fork trucks. In picture above three reels of wire are being brought to Test Department for checking before balance of the manufacturing process is completed. * *

A New Drawing Die: Diaferid

By Pierre Ferret
Director of the
ATELIERS FERRET-GOGLIO,
Dijon, France

SINCE the beginning of the application of tungsten carbide for wire drawing dies it was found that those dies were able to give a greater output for the drawing of steel wire than for the drawing of soft metals, such as aluminum, copper, etc. In fact, the output obtained with these dies for soft metals was found to be between 10 and 17% of the output obtained when used for steel wires.

★ ★ ★

UNDER these conditions, which necessitated the frequent changing of dies, wire drawing plants found it more economical to use the more expensive diamond dies particularly for wire size smaller than .040".

★ ★ ★

THE ATELIERS FERRET-GOGLIO, for 50 years specialists in the manufacture of dies, undertook the investigation of the problem of extending the life of carbide dies when used for soft metals.

★ ★ ★

THE following contains an outline of the problems that were involved:

Copper and its alloys are known as abrasive metals, in spite of their comparative softness.

A microscopic examination of the grain of the alloys of sintered powder dies shows very fine porosities which are due to the lack of sufficient bonding agent or binder in the alloy.

Soft metals which are drawn through these dies have a tendency to fill these microscopic porosities and in so doing to tear out and carry with them minute particles of the die metal.

This results in rather rapid enlargement of the die diameter. On the other hand, steel wires being much harder, do not tend to fill these pores and therefore dies have a longer life with steel wires.

It was therefore necessary to develop a more homogeneous metal for the dies, capable of an even finer polish.

★ ★ ★

RATHER than concentrating on decreasing the size of the carbide grains, which are already of the order of a micron, research was directed toward discovering a more suitable binder. This binder had to have a strength comparable to that of tungsten carbide so as not to weaken the working surfaces of the die.

★ ★ ★

THIS research, carried on over a period of years, resulted in a successful solution of the problem a few months ago.

★ ★ ★

IT was found that the quality of the binder alone was not the only factor involved, but also that a special costly manufacturing processes had to be devised.

★ ★ ★

THE combination of these efforts produced our special tungsten carbide grade called **"DIAFERID."**

This material has a hardness of 81 Rockwell on scale C. (150 kgs.), is capable of a perfect specular polish

MICROMETER PRECISION — MICRO-WELD — TRADE MARK REGISTERED

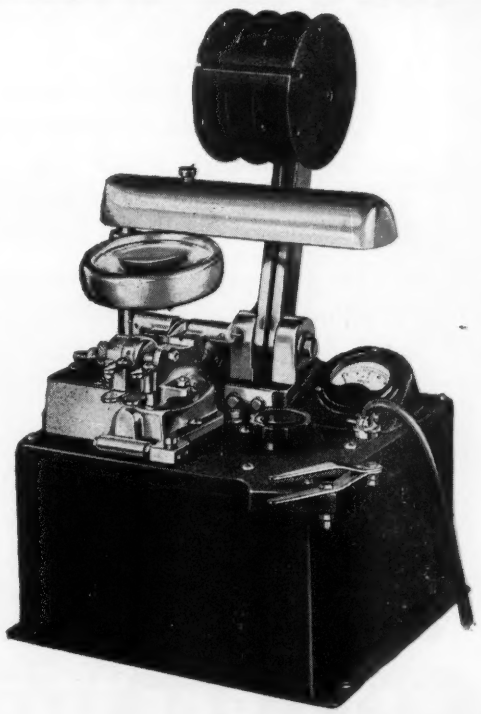
MODEL M-T, FOR BENCH MOUNTING

This welder was designed and developed expressly for welding all types of fine wire: Aluminum, Copper, Brass, Bronze, Steel and Steel Alloys, ranging in size from .005" to .020" diameter.

Unit design of frame, transformer and power sub-assemblies permit other range of sizes to suit requirements.

Equipped with a temperature indicating annealing and tempering device, voltage regulator and meter to compensate for voltage fluctuation, wire cutters, extra large 5" diameter magnifying glass, fluorescent light and extension cord. Welder can be supplied for bench mounting, or mounted on 4-wheel truck.

The adaptability of this unit for welding all types of wire, either ferrous or non-ferrous, in sizes from .005" to .020" diameter, makes it ideal for the fine wire manufacturer.



MICRO PRODUCTS CO.,

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Telephone: STATE 2-7468

PROLONGS DIE LIFE

FEWER REJECTIONS

REDUCES INSPECTIONS

For recessed heads, Keystone's new special-process wire delivers the desired upsetting and die forming qualities with such a high degree of uniformity that finished product rejections are practically eliminated . . . individual inspection of screws is no longer necessary . . . die and plug life are often more than doubled. This new wire effects considerable savings in the production of Phillips head, clutch head and cross recessed head screws.

Keystone is prepared to help solve any of your industrial wire problems. If special treatment is called for, Keystone's metallurgical research and testing facilities are available to supply the answers. We welcome your inquiry.

KEYSTONE
STEEL & WIRE CO.
PEORIA . . . ILLINOIS

Special Analysis Wire, Setting New Standards of Performance

and is hardly attacked by acids or abrasive metals.

Dies made of the new material can be made in diameters as low as .020", thereby replacing costly diamond dies.

For larger diameter they show a substantial increase in output (about 40% and more) over the old type of cemented carbide dies.

★ ★ ★

FOR further information, write to: G. Sahovaler, North American representative of the Ateliers Ferret-Goglio, 2040 Victoria St., Montreal, Canada.

★ ★ ★

New Stainless Makes Practical Heading and Upsetting of Parts

A NEW Chrome-Nickel austenitic stainless steel has made practical the economical production of parts which have been classed as "impossible" jobs. Such stainless parts include cold headed bolts and recessed head screws, cold upset and punched nuts, and parts that require severe cold coining and extrusion. Outstanding characteristic of the new material is that it work-hardens much slower than the conventional 18-8 types of stainless, and is therefore well suited to fabrication of fastenings and similar parts by drastic cold heading or upsetting.

★ ★ ★

THE name assigned to it is "Carpenter Stainless No. 10.*" Type analysis of the material, developed by **The Carpenter Steel Co.**, Reading, Pa., is as follows: Carbon 0.08% max., Chromium 16.00%., Nickel 18.00%. (See next page.)

★ ★ ★

ENGINEERS who have recognized a need for commercially-produced fastenings which provide the full corrosion resistance of 18-8 stainless will find that fastenings made from "No. 10" will fill a definite need. In addition to other types of fastenings made on a commercial scale from the No. 10, recessed-head screws are now being produced.

★ ★ ★

BECAUSE the material remains non-magnetic after severe cold working, it also has application in the making of parts for precision instruments.

★ ★ ★

THIS new stainless steel is being produced on a commercial scale in the following forms: forging billets, hot rolled bars and forgings, cold drawn and ground bars, wire and wire rods. Complete information on physicals, cold working properties, etc. are provided in a bulletin issued by The Carpenter Steel Co., Reading, Pa.

* Patent Pending.

★ ★ ★

Bulletin on Roller Chains

THE BALDWIN-DUCKWORTH DIVISION of Chain Belt Company has just published bulletin #49-2, "Unusual Applications of Roller Chains," which will be of value to all machinery and drive designers.

★ ★ ★

THE material for this 24-page bulletin, assembled with the help and cooperation of designers throughout the country, suggests the broad application of roller chain by means of a representative showing of very unusual applications.

★ ★ ★

EACH application is described, illustrated with photos and, in the case of complicated machinery, with simplified working drawings.

★ ★ ★

THIS bulletin is available for all interested engineers. To get a copy, write to the Chain Belt Company; 1600 West Bruce Street; Milwaukee 4, Wisconsin.

★ ★ ★

Division Set Up to Handle Loewy Rolling Mills

ERWIN LOEWY, President of Hydropress, Inc. and Loewy Construction Co., Inc., New York, has announced that the rolling mill business carried on by the latter will be operated as **Loewy Rolling Mill, Division of Hydropress, Inc.,** in the future. The considerable increase of Hydropress' activities in the design and construction of large rolling mill installations has necessitated this arrangement. Among many other domestic and foreign installations, the Loewy Group has on order a large blooming mill installation for Austria.

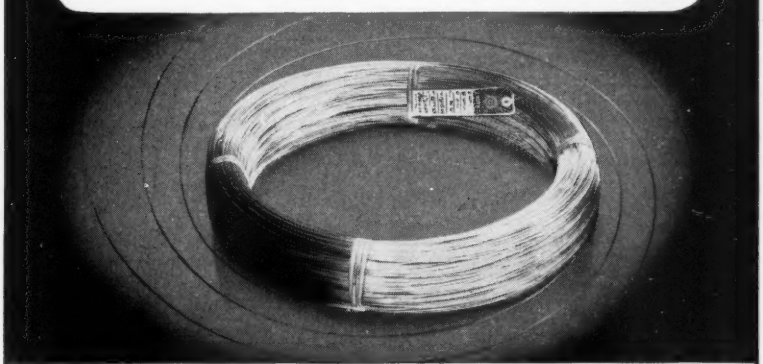
The Salesman:

"Johnson is not a tonnage mill. Although the Johnson line comes under a general heading of high carbon wire, there is a far wider range than that because Johnson draws wire to meet specific applications. Strict laboratory control and supervision assure the customer his own particular requirements will be met. Whether you are in the business of making bobby pins, springs or wire rope, Johnson experienced wire specialists study your problem and come up with the correct answer."

The Customer:

"That is exactly what we want here. Our application is an unusual one and we know enough about wire to realize that it requires careful research, and so we are asking you to show how Johnson meets this situation."

H. Armstrong Roberts Photo



JOHNSON
STEEL AND WIRE CO., INC.
WORCESTER 1, MASS.

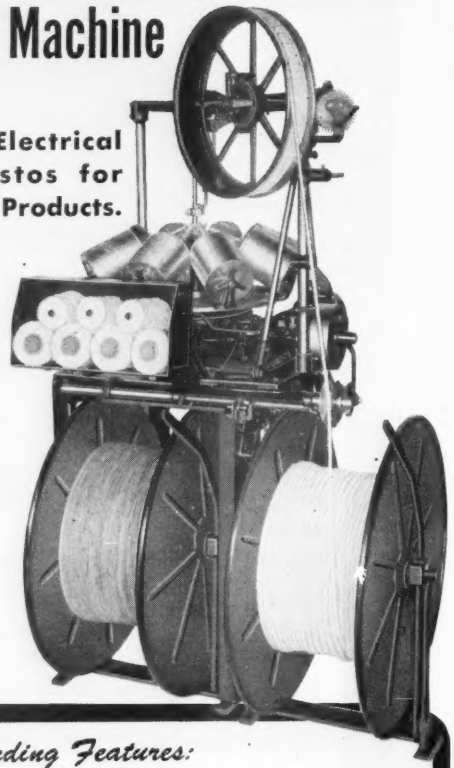
NEW YORK PHILADELPHIA CLEVELAND DETROIT AKRON CHICAGO
ATLANTA HOUSTON TULSA LOS ANGELES TORONTO

WARDWELLIAN®

Asbestos Serving Machine

TYPE "D"

Adapted For Serving Electrical Conductors with Asbestos for Heater Cords and Similar Products.



Plain or thread-reinforced asbestos roving, also cotton roving or other fibers may be employed as a covering medium.

The machine stops automatically upon exhaustion or breakage of the serving material and direction of rotation of the supplies may be changed to serve with either a right- or left-hand wrap.

Equipped with adjustable traverse, supply and windup stands and windup driving mechanism.

Outstanding Features:

- Capacity one to eight supply packages.
- Production dependent upon construction of product
- Machine equipped with electric stop-motion
- Standard set of seven change-gears furnished with each machine.
- Serving head speed 300 R.P.M.
- Driving pulley 7" diameter, 1¾" belt. Speed 690 R P.M.
- Ratio pulley speed to serving head speed 2 3 to 1.
- Capstan 18" diameter, 3" face.
- Opening through serving head ⅝" diameter
- Maximum diameter of conductor covered, No. 4 solid or ½" diameter semi-flexible.
- Supply packages Universal wound, 4" diameter, 4" traverse, on cones 4¼" long, 1⅞" hole at base; three point wind.
- Maximum power requirement ½ H.P. including power transmission equipment.
- Individual motor-drive furnished upon request.
- Stands can be furnished to take reels as follows:

24" diameter and up to 10½" outside width
24" diameter and up to 13" outside width
24" diameter and up to 16" outside width
30" diameter and up to 10½" outside width
30" diameter and up to 13" outside width
30" diameter and up to 16" outside width

- Reels are not included with the machine.

Complete detailed information on "WARDWELLIAN" Asbestos Serving Machine on Request

There are nearly thirty different applications for Wardwell equipment, including Braiding, Shielding with wire, Tape Serving, Yarn Serving, Asbestos Serving, Paper Serving, Armor Serving and Resistance Wire Serving.

WARDWELL BRAIDING MACHINE CO.

Central Falls Rhode Island, U. S. A.

Representatives for Europe, British Colonies and Dependencies

JAMES MACKIE & SONS, LTD., BELFAST, IRELAND

Oakite Features Latest Developments in Cleaning and Related Materials at ASTE Exposition

OAKITE PRODUCTS, INC., New York, manufacturers of specialized cleaning products, are featuring recent additions to their line of metalcleaning and allied materials in Booth 565 at the Tool Engineers Exposition in Philadelphia, April 10-14.

★ ★ ★

IN line with Show's "Cost-Cutting" theme, the exhibit will feature Compound No. 33, a new, acid-type cleaning and surface-conditioner for ferrous metals and aluminum, as well as Composition No. 38, a recently developed material which forms a dense foam-blanket on pickling solutions to prevent the escape of acid fumes. Other materials in their display will be: Compositions No. 91 and 91A, which, when used together, provide improved electrocleaning of brass and copper; Composition No. 90, an electrocleaner for steel; and Pickle Control No. 3 a specially designed inhibitor for pickling solutions that prevents waste of acid after scale or rust is dissolved.

★ ★ ★

THE booth will be staffed by J. J. Basch, Philadelphia Division Manager, assisted by main office chemists, engineers and metal specialists from the company's field service organization.

★ ★ ★

New Use for Monel

CRAB-TRAPS, often made of copper wire on a steel frame, of galvanized or of tarred cotton netting, all have relatively short life. Electrolytic action between a ¾" steel frame and copper wire would corrode through the frame.

★ ★ ★

BY substituting monel wire netting for other materials, it is found that the monel traps have twice the life of copper and an average of three times the life of other types, besides lightening the weight of traps due to the lighter gauges of monel wire that can be used.

★ ★ ★

Outstanding Personalities of the Wire Industry

Cleborne Heads Allegheny Ludlum

E. B. CLEBORNE, executive vice president, **Allegheny Ludlum Steel Corp.,** Pittsburgh, has been elected president to succeed **H. G. Batcheller,** who was elected chairman of the board. Mr. Cleborne is succeeded by **Edward J. Hanley,** vice president in charge of finances and treasurer. **Clark W. King,** vice president, was elected treasurer succeeding Mr. Hanley in that position. The company accepted resignations of **Messrs. William E. Ruder** and **John W. Belanger** as directors, which, with the death of **James O. Carr** earlier in the year, created three vacancies. Mr. King was elected to one of the vacancies, another was filled by **Russell M. Allen,** vice president in charge of sales, and the last was filled by **William J. Kyle.** Mr. Ruder has been a director since 1933 and Mr. Belanger has served on the board since June, 1949, Mr. Cleborne, the new president, has been a director of Allegheny Ludlum since 1935. He became a vice president in 1938 and executive vice president in 1947.

* * *

Thomas A. Brown Appointment

THOMAS A. BROWN has been appointed assistant manager of operations of the Pittsburgh and Graham plants of **Pittsburgh Screw and Bolt Corp.** Mr. Brown was formerly division superintendent of the McDonald Mills of Carnegie-Illinois Steel Corp., Youngstown.

* * *

American Brass Company Appointment

CLINTON E. SWIFT, welding engineer specialist, has rejoined **American Brass Co.,** Waterbury, Conn., and will have a leading part in the company's stepped up research and promotional activities on Anaconda welding rods.

* * *

Phelps Dodge Adds to Washington Office

WYLIE BROWN, Chairman of the Board, **Phelps Dodge Copper Products Corporation,** announced that **F. Carlin Gray** has joined the company's Washington office. Mr. Gray is well known in the industry and previously was associated with the Copper Wire Engineering Association as an engineer.

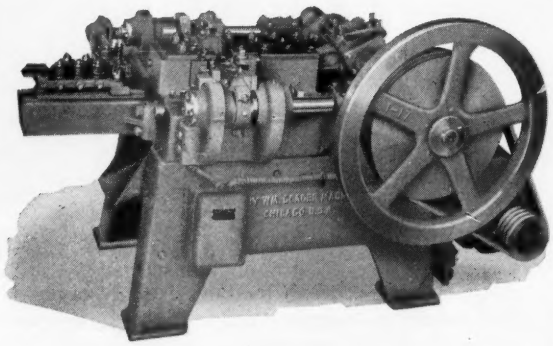
* * *

Nichols Appoints New England Manager

THE NICHOLS WIRE & ALUMINUM CO., Davenport, Iowa, announces the appointment of **Edward C. Manix** as Manager of the South Deerfield, Massachusetts, Branch of Nichols Wire & Aluminum Co.

* * *

GLADER HIGH SPEED WIRE NAIL MACHINE



MACHINE ARRANGED FOR INDIVIDUAL MOTOR DRIVE

High tonnage output, and low maintenance costs, have resulted in Glader Machines being accepted as standard equipment in every large nail mill built in the United States in the past twenty years.

Glader Machines are operating in most of the wire producing mills throughout the world.

These machines are made in eleven different types and sizes. This enables us to cover the range of sizes of nails produced with the greatest efficiency.

For further information please address,

WM. GLADER MACHINE WORKS
210 No. Racine Ave.
Chicago 7, Illinois
Export Dept.: 122 E. 42nd Street, New York 17, N. Y.

THIS Branch distributes Nichols NEVER-STAIN Aluminum Nails, Aluminum Clothesline, and other Aluminum Building Products through the New England Region.

★ ★ ★

MR. MANIX was formerly Manager and Treasurer of the Arms Manufacturing Company, South Deerfield, Massachusetts.

★ ★ ★

IN addition to the South Deerfield, Massachusetts, Branch, the Nichols Wire & Aluminum Co. operates branches at Battle Creek, Michigan, Mason City, Iowa, and maintain regional warehouses in Seattle, Washington, and Oakland, California.

★ ★ ★

MacDonald Advanced to Presidency of Houghton

WILLIAM F. MacDONALD was elected President of **E. F. Houghton & Co.**, manufacturers of industrial oils, leathers and chemicals, at the annual stockholders' meeting held at the company's main offices at 303 W. Lehigh Ave., Philadelphia, on February 14th.

★ ★ ★

MR. MacDONALD, who will temporarily continue to hold also his present office as Treasurer, succeeds Major Aaron E. Carpenter, who voluntarily relinquished the presidency and was elected Chairman of the Board of Directors. By-laws provide that Major Carpenter shall still remain the chief executive officer of the company. He has been president since 1934, during which period, the company's peace-time sales have quadrupled.

★ ★ ★

MR. MacDONALD, who is 46, was graduated from Wharton School, University of Pennsylvania, in 1927 and entered the employ of F. F. Houghton & Co. that year as a cost clerk. He has since served as industrial engineer, credit manager and Treasurer (1942). He was also named assistant to the president in 1946.

★ ★ ★

Heads Alcoa's New Patent Department

A. H. SCHMELTZ has been named manager of **Aluminum Company of America's** newly-established Patent Department, it was announced in Pittsburgh today.

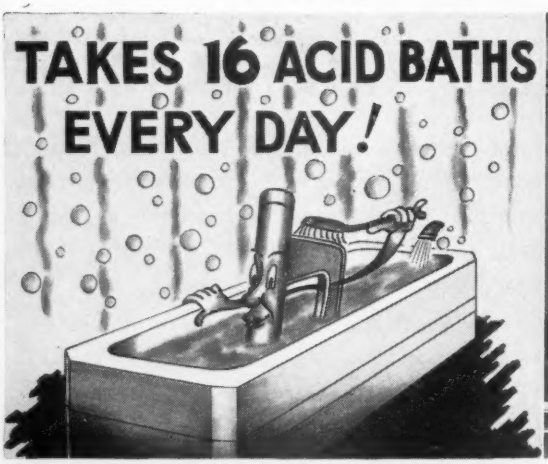
★ ★ ★

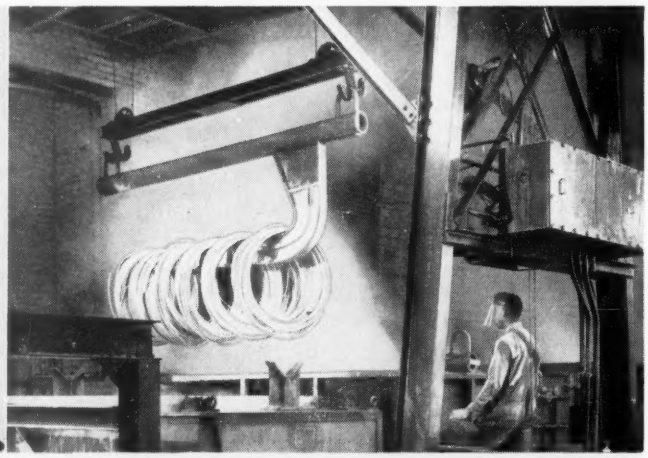
ALCOA'S patent activities were formerly a part of the Company's research laboratory organization. Under the new arrangement, the patent department will report directly to the general management of the Company, thus providing broader patent service to all Alcoa divisions.

★ ★ ★

A GRADUATE of the University of Pittsburgh and the George Washington University School of Law, Mr. Schmeltz has spent his entire professional career with Alcoa, having joined the Company in 1929.

★ ★ ★





Yet this Weldco Pickling Hook Is Still On the Job After 3 Years' Service!

Installed in the Lamson & Sessions rod and wire mill in November, 1946, this lightweight hairpin hook is still going strong—in spite of continuous loading, pickling, liming and washing operations. This rigorous work goes on day after day, yet the Weldco hook stays right on the job . . . shows very little corrosion from the daily baths of hot 5% sulphuric acid solution. And thanks to its high strength, the hook carries payloads of 3000 pounds!

Weldco lightweight hairpin hooks will show an excellent service record in your plant, too. Why not find out today how they can improve your pickling operations and cut costs?

THE YOUNGSTOWN WELDING & ENGINEERING COMPANY

3735 OAKWOOD AVENUE . . . YOUNGSTOWN 9, OHIO

Charles M. Kay, Appointment

CHARLES M. KAY has been appointed division superintendent of steel works of **American Steel & Wire Company's** South Works in Worcester, Mass., U. F. Corsini, general superintendent, has announced.

★ ★ ★

MR. KAY, 34, succeeds to the office vacated by Mr. Corsini, whose appointment as general superintendent was announced recently. Mr. Kay began his employment with the Wire Company in June of 1936 as an observer in the company's Donora (Pa.) plant. After 18 months' service there he was promoted to senior observer, before becoming works metallurgist at the Allentown (Pa.) plant.

★ ★ ★

IN February of 1943 he was named division metallurgist at South Works, and a year later was transferred to the office of the manager of metallurgy in Cleveland (O.) for a short period. He returned to South Works as assistant division superintendent of the steel works in August, 1945.

★ ★ ★

Fred M. Shelley and A. G. Dennison Head Riverside Sales Organization

IN January the sales and service organization of **The Riverside Metal Company,** Riverside, New Jersey, producers of nickel-silvers, phosphor-bronzes, and beryllium-copper, were provided with new leadership in the persons of **Fred M. Shelley, Jr.,** and **Alfred G. Dennison,** appointed to the posts of General Sales Manager and Assistant General Sales Manager, respectively.

★ ★ ★

THE announcement was made by **James T. Duffy, Jr.,** President, at an annual meeting of Riverside officials and executives on January 3 and 4. Mr. Duffy directed sales activities himself from midsummer up to the realignment of forces now completed.

★ ★ ★

MR. SHELLEY is one of Riverside's oldest employees, currently rounding out his 30th year with the firm. Mr. Dennison comes from the copper business. He joined Riverside in 1945 and has been active in the evolution of its sales, advertising and sales promotion operations.

★ ★ ★

Joins Brush Beryllium Company

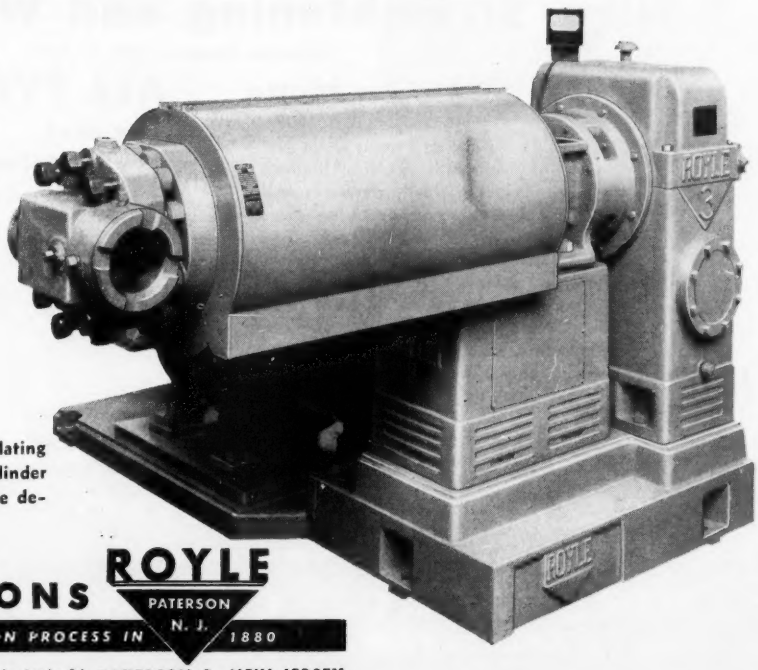
HAVING obtained his master's degree in metallurgical engineering at the Missouri School of Mines and Metallurgy, **Walston Chubb, Jr.,** whose paper on wire cloth is currently running in Wire and Wire Products in four installments, has joined the engineering staff of the **Brush Beryllium Company** at Luckey, Ohio.

★ ★ ★

MR. CHUBB'S research work at the Missouri School of Mines

ROYLE *for WIRE INSULATING*

- **Continuous Vulcanizing Machines for Rubber Wire Insulation**
- **Plastic Wire Insulation Machines**
- **Strainers • Cooling Troughs**
- **Light Wire & Cable Capstans**
- **Motorized Take-Ups**
- **Temperature Control Units for Extrusion Processes and other industrial uses**



ROYLE # 3 Plastic Wire Insulating Machine. Double extended cylinder enclosed in insulating jacket, side delivery head.

JOHN ROYLE & SONS ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

London, England — James Day (Machinery) Ltd. REgent 2430
Home Office — J. W. VanRiper SHerwood 2-8262
Akron, Ohio — J. C. Clinefelter JEfferson 3264
Los Angeles, Cal. — H. M. Royal, Inc. LOgan 3261

PATERSON 3, NEW JERSEY

and Metallurgy was carried on under the Fellowship sponsored by the **Ludlow-Saylor Wire Company** of St. Louis.

★ ★ ★

Harold J. Newton Resigns

HAROLD J. NEWTON resigned on March 1 as Vice President and General Sales Manager of **National Electric Products Corp.**, Pittsburgh, after a period of 38 continuous years with them. He was made Vice President and a director in June, 1948.

★ ★ ★

To Head Alcoa's Export Division

JOHN M. MITCHELL has been appointed manager of **Aluminum Company of America's** Export Division, and **G. B. D. Peterson** has been named head of the Division's New York office. Appointment of Mr. Mitchell and Mr. Peterson to their new posts was announced by Mr. R. V. Davies, Vice President and General Sales Manager.

★ ★ ★

Apex Alkali Appointment

CARROLL D. CATE has been appointed West Coast Representative with headquarters at Los Angeles.

Carroll D. Cate, West Coast Representative for Apex Alkali.

★ ★ ★

THIS move brings Apex's activities to the coast, with the hope that their long experience in the wire field will be of real assistance to Western Mills.

★ ★ ★

Sidney Rolle to Visit Europe

SIDNEY ROLLE, Assistant Manager of The Scomet Engineering Company, expects to depart on April 13th for England and the Continent, where he will visit metallurgical plants interested in large capacity induction furnaces for melting non-ferrous metals.

★ ★ ★

R. O. Bridge, Purchasing Agent

R. O. BRIDGE was named purchasing agent of the CRUCIBLE STEEL CO. OF AMERICA, with **C. C. Kennedy** filling the post of assistant purchasing agent. Both men are stationed in Pittsburgh, where Crucible purchasing activities are centered.

The SPECIALISTS in Wire - Straightening and Wire - Cutting!

Diameter Range — 1/16" to .005"

PRECISION - Our Motto

DON'T hesitate to call on us when you are confronted with wire-straightening problems involving close tolerances and absolute accuracy. For seventeen years we have specialized in straightening and cutting all gauges of fine wire, hard or soft, ranging in diameter from one-sixteenth of an inch down to five-thousandths of an inch. We employ gun-barrel accuracy in straightening lengths from one inch to ten feet or any fractional part thereof. Ends cut absolutely clean without burrs.

ASK ABOUT OUR UNEXCELLED FACILITIES FOR CLEANING AND POINTING WIRE ALREADY STRAIGHTENED AND CUT.

ALL TYPES OF WIRE...

- Nickel
- Stainless Steel
- Bronze
- Brass
- Copper
- Alloy Wire
- Music Wire
- Tag Wire
- Florist Wire

Write us today!

Manufacturers of the famous ARMA PAPER CLIP

PITTSBURGH CUT WIRE COMPANY

1112-20 GALVESTON AVENUE · PITTSBURGH, PENNSYLVANIA.

TELEPHONE: CEdar 4702

Atlantic Steel Company to Hold Open House May 5-6

"DIXISTEEL on Dixie Farms" will be the overall theme of the **Atlantic Steel Company's** Open House, May 5 and 6, in Atlanta, Georgia. The occasion will emphasize the variety of products this company makes for Southern farms and the wide range of prime materials and fabricated parts which it supplies to manufacturers of agricultural machinery and equipment.

★ ★ ★

R. S. **LYNCH,** Atlantic Steel Company President, states that exhibits will be located throughout the plant. **Emmett R. Rushin** and **Michael F. Wiedl** have been named to handle exhibit arrangements. Displays of machinery and equipment made by Southern agricultural implement concerns which use Atlantic Steel Company's prime materials or processed parts in the manufacture of finished products will be shown.

★ ★ ★

ATLANTIC Steel finished products, such as field fence, nails and wagon hardware, which go directly into the farm market will also be prominently displayed. These exhibits will feature the latest developments which Atlantic Steel Company engineers have pioneered for Dixie farms. A model country hardware store showing field fence, barbed wire, nail products, packaged goods and general hardware items will be located in the Wire Products Division.

★ ★ ★

CUSTOMERS, civic and industrial leaders, engineering groups and technical associations, stockholders, and Atlantic Steel Company employees are being invited to attend the Open House celebration. The trip through the plant will include these departments: Open Hearth, Soaking Pits, Blooming Mill, Bar Mill, Strip Mills, Wire and Nail Mills, Galvanizing Departments, Manufactured Products Department, Forge Shop, Machine Shop, Roll Shop, Shipping Department and various Warehouses and related departments and shops.

★ ★ ★

New Carboloy Header Die Supplement to Catalog

THE CARBOLOY COMPANY, Detroit 32, Mich., has issued Supplement D-4 to their Die Catalog No. D-126. It covers standard rough cored header die nibs.

★ ★ ★

DUE to the increasing demand for carbide header dies plus the fact that nib sizes are now standardized, the company announces that it is maintaining a stock of these nibs out of which it can make immediate deliveries.

★ ★ ★

A COPY of this supplement giving specifications and prices will be sent to you upon request.

★ ★ ★

Send in
Your Order Now
for the
1950 Wire Buyers Guide

Only HYPREZ can do a Hyprez Job!

IN FINISHING
WIRE DIES AND TOOLS

A Difficult Die Hyprez Finished To Perfection

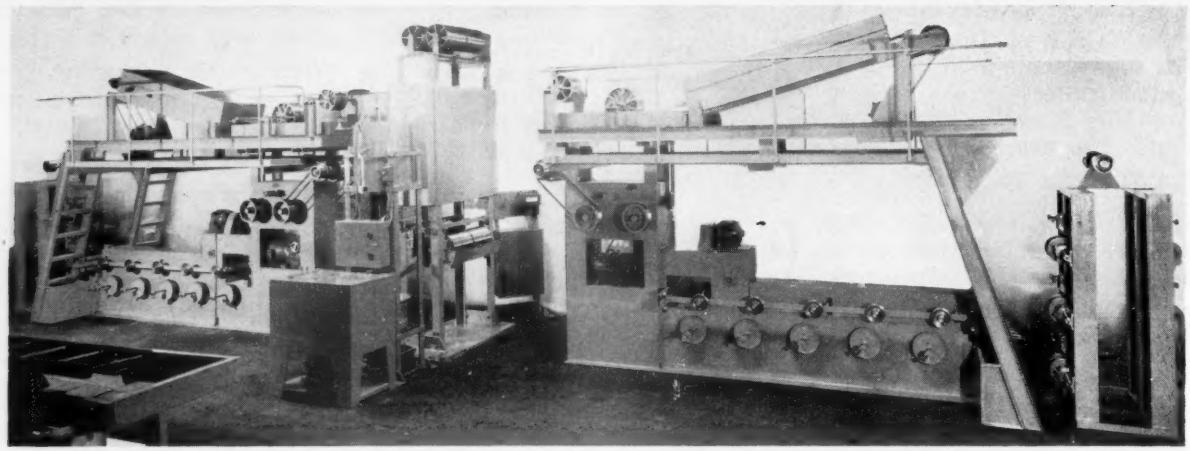
Photo courtesy of Eastern Carbide Corp., New Rochelle, N. Y.

- HYPREZ DIAMOND COMPOUNDS are formulated of precision-graded, fast-cutting, virgin diamond particles.
- HYPREZ diamond particles are permanently suspended and uniformly distributed in a base of different color for each grade.
- HYPREZ will "stick to the job" and remain stable and uniform at all normal temperatures.
- HYPREZ is packed in dust-proof transparent cartridges (30, 18 and 5 gram content) identified by grade marking and individual color.

- HYPREZ is applied to work from easily operated and waste-saving applicator gun in exactly metered quantities.
- HYPREZ offers 26 engineered standards precisely graded for a complete and perfect job—from rough finish to mirror polish.

For this technique folder or for a free demonstration write to Dept. W-450.

HYPREZ DIAMOND COMPOUNDS
AN EXCLUSIVE PRODUCT OF
HYPREZ DIVISION
ENGIS EQUIPMENT CO., 431 S. DEARBORN ST. CHICAGO



DOUBLE SIDE WIRE ENAMELING MACHINE, No. 997, with Electric Heated Oven, shortened for photograph.

Complete with Electric Heated Pre-Annealers, Enamel Storage, Circulating and Filtering System.

EST. 1855 AIMco INC. 1919

"American" INSULATING MACHINERY COMPANY

REG. U.S. PAT. OFF.

517 West Huntingdon St.
Zone 33

PHILADELPHIA PENNSYLVANIA U.S.A.

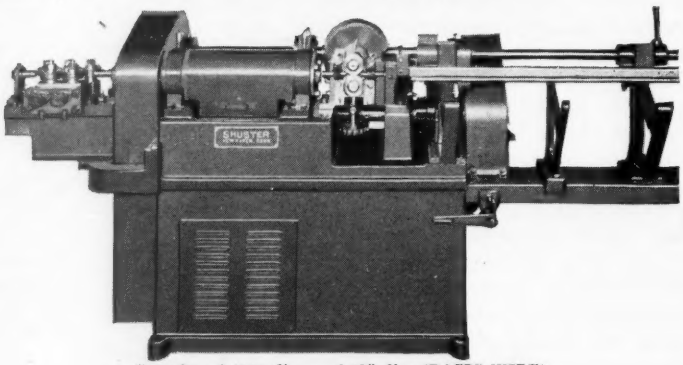
This New, Economical "SHUSTER" *Cuts Costs* AND *Accurate Lengths!*

Model 2AB

Automatic

WIRE STRAIGHTENING AND CUTTING MACHINE

This new "SHUSTER"—with its five gear-driven straightening rolls—handles even badly twisted wire with ease. Square and rectangular as well as round wire may be straightened and cut to exact lengths. Other "Shuster" features that assure high speed, quality production are: almost continuous wire travel, rapid cut-off, V-belt motor drive, ball and roller bearings, and extreme rigidity throughout. Write for details.



Capacity: 3/16" dia. — 3/8" dia. (BASIC WIRE)

Mfd. by METTLER MACHINE TOOL, INC., 132W Lawrence St., New Haven, Conn.

SHUSTER *Automatic*

Since 1866

WIRE STRAIGHTENING AND CUTTING MACHINES

Representatives in all principal cities and in foreign countries.

Guest Keen and Nettlefolds Publish Book on Wire Rope Production

AN exceptionally fine book entitled, **"The Development of Wire Rod Production,"** has been published by **Guest Keen and Nettlefolds (South Wales), Ltd.,** for private circulation.

* * *

THE study reviews the development of wire rod production, assesses the trend of the demand and examines the need for increased capacity.

* * *

CHAPTER 3 is particularly noteworthy in its description of the evolution of the rod mill from the first simple two-high roll stand with flat rolls to the modern multiple stand continuous mills.

* * *

CHAPTER 4 is devoted to an interesting comparison of U.K. and U.S.A. rod mills, with mills of varying capacities, as to number and capacity, shown statistically.

* * *

COMBINING history with an analysis of present and future requirements, the study may be considered a very worth-while effort and one that represents a vast amount of careful research and thought on the part of the author, **Leslie Thomas.**

* * *

Four District Offices Designated by Youngstown

FOUR former sub offices have been designated district sales offices by **The Youngstown Steel Products Company,** representing **The Youngstown Sheet and Tube Company.**

* * *

THEY are Grand Rapids, Mich., formerly maintained as a branch under supervision of the Detroit office; Des Moines, Ia., Milwaukee, Wisc., and Minneapolis, Minn., all three formerly under Chicago office.

* * *

MEN formerly in charge of these sub offices have been designated district sales managers; **E. N. Hagstrom** at Grand Rapids; **W. J. Burt** at Des Moines; **J. J. McMahon** at Milwaukee and **Charles S. Hogan** at Minneapolis.

* * *

National-Standard Co. Buys Outstanding Stock of Reynolds Wire Co.

WALTER H. PARKIN, president of the National Standard Company of Niles, Mich., has announced that the company has acquired all of outstanding capital stock of Reynolds Wire Company, manufacturers of fine wire, wire cloth and meshes with plants located at Dixon, Ill.

For the present, National-Standard intends to operate Reynolds Wire Company as a wholly-owned subsidiary.

* * *

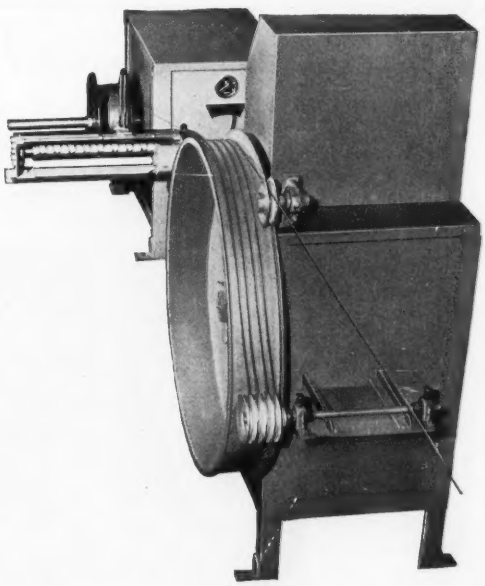
DAVIS CAPSTAN and TAKE-UP

For Thermoplastic Extrusion

HANDLES ANY VARIATION OF WIRE SPEED FROM 50 TO 1500 F.P.M.

Capstan is motor-driven, with variable speed range of 15 to 1; tachometer indicates speed in F.P.M.

A motor-driven take-up varies the speed and tension of the wire by tapped inductances. Is equipped with adjustable traverse to accommodate reels up to a maximum width of 14" and will take reels up to 30" in diameter.



Write us today for detailed information!

DAVIS EQUIPMENT

THE R. L. DAVIS ELECTRIC CO., INC. • WALLINGFORD, CONN.

SPARK TESTERS • SPOOLERS • TAKE-UPS • CAPSTANS

A Review of Recent Wire Patents

NO. 2,496,847, WIRE WINDING MACHINE PARTICULARLY FOR ELECTRIC HEATING ELEMENTS, patented February 7, 1950 by Alexander Jaques Emil Behm and Elsie May Behm, Nottingham, England.

This machine is provided for winding a single piece of resistance wire helically onto two flat formers simultaneously in such manner that the helices on the two formers are of opposite spirality.

★ ★ ★

NO. 2,496,913, MECHANISM FOR FORMING COILS, patented February 7, 1950 by Gustave L. Grundmann, Westmont, N. J., assignor to Radio Corporation of America, a corporation of Delaware.

A wire coil winding mandrel is disclosed including a curved body portion and a slot-forming member with its inner face spaced varying distances from the curved face of the body portion in order to provide wire winding slots of progressively decreasing width. A guide device is also provided adjacent the ends of the member for forming end turns of strands which are continuous with strands wound in the slots.

★ ★ ★

NO. 2,497,260, ELECTRICAL CONTROL FOR FENCE WELDING MACHINES, patented February 14, 1950 by Harry E. Griesemer, Bloomington, Ill., assignor to Northwestern Steel and Wire Company, Sterling, Ill., a corporation of Illinois.

Successive cross wires are applied to the line wires, squeezed between movable electrodes and a controlled welding current applied thereto.

★ ★ ★

NO. 2,497,894, METHOD OF ELECTROPLATING FINE WIRE OF LOW ELASTIC LIMIT, patented February 21, 1950 by Clare Luke, Berrien Springs, Mich., assignor to National-Standard Company, a corporation of Michigan.

The wire is withdrawn from the spool in an initially vertical position, then passed in catenary suspension of a depth not exceeding one inch below the vertical position and at a speed of at least several hundred feet per minute to a rotating power driven take-up through the overflow meniscuses of at least one aqueous liquid metal plating bath, the wire being suspended between only two points and being free from contact with any solid body therebetween, current is supplied to the wire during such passage through connections including only the bath and the take-up, while maintaining upon the wire a tension less than that required to stretch it beyond its elastic limit.

Complete Description and Drawings of Patents May Be Had for 50 cents, outside the United States and Canada $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

★ ★ ★

NO. 2,498,066, BOBBY PIN, patented February 21, 1950 by Edward L. Challinor, Los Angeles, Calif.

This pin is constructed of bent wire formed into loops and arms.

★ ★ ★

NO. 2,498,494, ELECTRICAL CABLE, Patented February 21, 1950 by Latimer F. Hickernell, Irvington, N. Y., assignor to Anaconda Wire and Cable Company, a corporation of Delaware.

A power cable is provided having an exterior sheath about the wire conductors, and which cable comprises a layer of fibrous insulation impregnated with an insulating oil over the conductor, a layer of composite sheet material over the insulation, said composite sheet being electrically conducted both longitudinally and transversely and presenting an adsorptive medium for the insulating oil and comprising a sheet of paper impregnated with adsorbent carbon to provide the adsorptive medium for impurities in the oil and a metal foil bonded

Hydraulically Operated **TRAVERSE REELS**

FOR FLAT WIRE AND NARROW STRIP

• The self-contained, compact SECO Traverse Reel has smooth, powerful hydraulic operation — at speeds from 150 to 600 feet per minute.

PERFECT SPEED CONTROL from zero to top running speed through flow control.

ACCURATE TENSION CONTROL through pressure regulation.

Built in sizes for coils weighing up to 600 lbs., for round or flat wire. Unit shown occupies floor space 24" x 42". Modifications in design and construction to meet specific requirements.

WIRE SPOOLERS

Single and Multiple Type

Speeds Up To 4,000 feet per minute

STEEL EQUIPMENT CO.

SECO 2890 EAST 83rd STREET CLEVELAND 4, OHIO

to the adsorptive carbon-impregnated paper with a current conducting adhesive having particles of carbon dispersed therein in an amount ranging from 1% to 50% by weight of the adhesive, the paper being in contact with the insulation and the metal foil being in contact with the metal sheath.

★ ★ ★

NO. 2,499,246, STRANDING MACHINE, patented February 28, 1950 by Albert G. Harmon, South Bend, Ind., assignor to National-Standard Company, Niles, Mich., a corporation of Michigan.

Electro-magnetic devices are included in this machine construction and associated with a rotatable cradle carrying spool of the wire and two rotors with the devices spaced apart to provide a gap therebetween for passage of the strand of wire from the lower rotor to the upper rotor.

★ ★ ★

NO. 2,499,283, INHIBITED HYDROCHLORIC ACID, patented February 28, 1950 by Harold A. Robinson, Midland, Mich., assignor to The Dow Chemical Company, Midland, Mich., a corporation of Delaware.

A composition is provided for treating iron surfaces and comprises 5 to 25 per cent of HCl, 0.1 to 2 per cent of a water-soluble organic ring nitrogen-base selected from the group consisting of acridine, pyridine, quinolines and their homologues, and 0.1 to 2 per cent of phenyl hydrazine, the balance being water.

★ ★ ★

New Bulletins Issued

THREE new bulletins of interest where corrosive liquids are used have been issued by the **Maurice A. Knight Co.**, Kelly Ave., Akron 9, Ohio.

★ ★ ★

No. 1K. describes Permanite acid and alkali-proof pipe and fume ducts. Permanite is a resin material.

No. 2K. gives information on Pyroflex construction equipment for pickling, plating, storage and other tanks. Pyroflex is a thermoplastic sheet lining used in corrosive equipment.

No. 3K. covers Pyroflex lacquer, a tough coating material for metal, concrete or wood that can be applied like paint to tanks or other equipment to make surfaces impervious to acids, alkalies, oils, alcohols and other fluids or gases.

★ ★ ★

THE company will be glad to send one or all of these informative bulletins to any of our readers upon request.

★ ★ ★

New Bulletins on Beryllium Copper

THE BERYLLIUM CORPORATION, Reading, Pa., has issued new bulletins covering strip, bar rod and wire: Bulletin 12, How to Order Beryllium-Copper Strip, and Bulletin 13, How to Order Beryllium-Copper Rod, Bar and Wire.

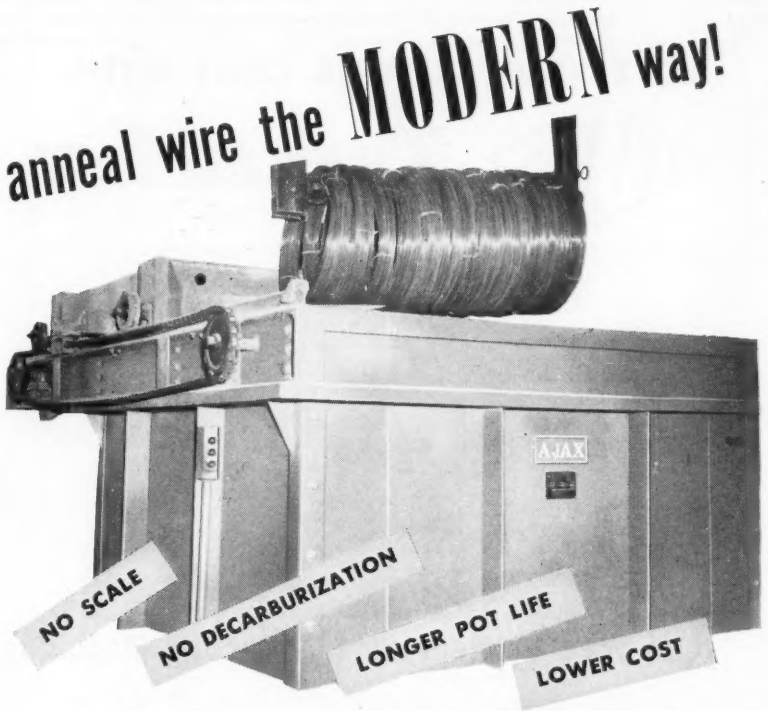
★ ★ ★

THESE new publications make available for the first time complete data for specifying beryllium copper wrought products. A discussion of available alloys, conditions and tempers is included together with tables covering mill sizes and properties.

★ ★ ★

THIS literature on beryllium copper will be found to be of practical interest and value to those using this metal. Copies will be sent free of charge upon request.

★ ★ ★



You'll save money, you'll improve efficiency along many lines with the unique Ajax Electric Salt Bath wire annealing method. It requires less floor space, less labor, less maintenance. Heating cycles average less than 20 minutes, even on difficult jobs. There is no scaling, no decarburization, no explosion hazard, none of the bothersome problems entailed with atmosphere equipment. Salt bath treating does the work faster, better, cheaper!

Ideal for annealing low- or high-carbon and stainless steel wire and rod; annealing aluminum, and copper and silver alloys; and for descaling stainless and alloy steel wire in molten salt baths.

AJAX ELECTRIC COMPANY, INC.
Frankford and Delaware Aves. · Phila. 23, Pa.
The World's Largest Manufacturer of Electric Heat Treating Furnaces Exclusively

WRITE FOR YOUR COPY!
This 72-page Ajax booklet tells the entire story of salt bath heat treatment as applied throughout modern industry. Ask for Booklet 116.

AJAX HULTGREN ELECTRIC SALT BATH FURNACE

Flexible High Temperature Electrical Insulation

(*Continued from page 298*)

TABLE V

Physical and Electrical Properties Silastic R-12 and R-20

	R-12	R-20
Thickness	.012" ± .002"	.020" ± .002"
Tensile Strength P.I.W.	45	60
Power Factor @ 10^2 C.P.S.	0.0061	0.0061
Power Factor @ 10^3 C.P.S.	0.0033	0.0033
Power Factor @ 10^5 C.P.S.	0.0012	0.0012
Dielectric Constant @ 10^2 C.P.S.	6.60	6.60
Dielectric Constant @ 10^3 C.P.S.	6.53	6.53
Dielectric Constant @ 10^5 C.P.S.	6.47	6.47
Dielectric Strength V/Mil.	400	250

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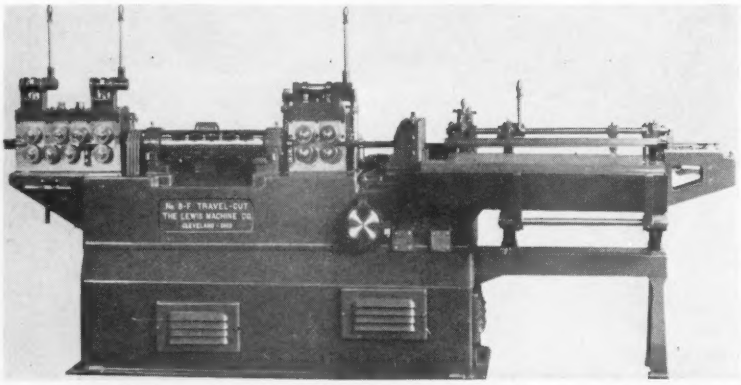
LEWIS TRAVEL-CUT



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The simplicity of design and rigid construction of the Lewis Travel-Cut makes it well suited for the most severe high-production requirements. This machine feeds the wire from the coil, straightens, gauges to accurate length, and cuts while in motion thus producing uniform diameter rod free of arbor swell and feed roll marks. It is particularly adapted to precision work on bright finished steel, brass, aluminum, stainless, and alloy wire. This method of cutting is also very efficient for short lengths such as welding rod, special bolts, etc., and increases the over-all efficiency approximately 20% over the conventional type of cut-off.

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the Silastic Rubber forms a homogeneous mass, free from voids and air pockets. This material designated as R-12 and R-20 is available in tape form in thicknesses of .012" and .020". It is made by applying a special silastic rubber to fiberglas cloth and then slitting it into tape of any desired width.

★ ★ ★

IN order to insulate equipment properly with R-12 and R-20, the object is taped to the required thickness with the tape and a cotton or glass tape is applied over the layers to give pressure during the vulcanization period. After the equipment, such as a coil or cable or motor, is taped the whole assembly is vulcanized at 300°F for a short period of time. Following this initial curing, the assembly must be cured at elevated temperature by gradually raising the temperature over a period of time to 500°F—550°F. Test results on the cured material are shown in Table V.

★ ★ ★

Advantages of Class "H" Insulation

THE thermal endurance of electrical insulation has long been recognized as one of the important limiting factors in the design of electrical machinery and insulation. With the commercial availability of at least five flexible Class "H" materials, designers can now take advantage of this increased thermal stability in many ways.

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4. **Design apparatus to operate continuously in high ambient temperatures.**

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THESE four advantages indicate a continually increasing use of these materials in motors, generators, transformers and cables.

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A SHORT transmission line employing ACSR with an aluminum coated steel core wire instead of the usual zinc galvanized core was recently put into operation by Aluminum Company of America, as part of the expansion of the testing facilities of its electrical research division. The line, operating at 460 volts, consists of approximately 2800 ft. of No. 4 ACSR 6/1. Research has indicated that aluminum coated steel may be superior to zinc galvanized wire for this purpose.

* * *

ALUMINUM COMPANY OF AMERICA has been doing developmental work on aluminum coated steel wire for some time. The small amount used in this installation was fabricated solely for experimental purposes and without conforming to tensile specifications. It is not commercially available.

* * *

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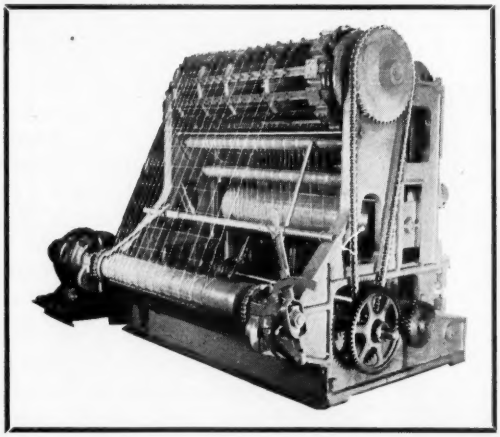

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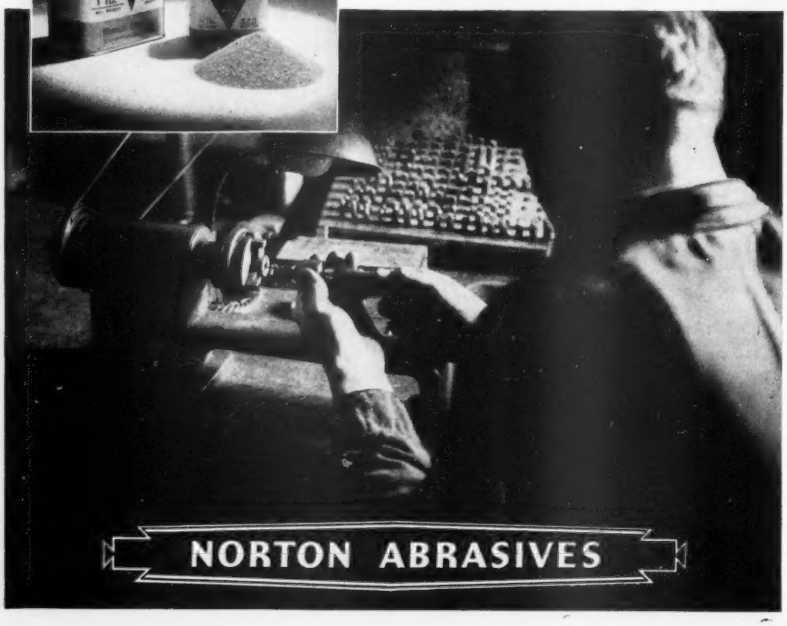

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★ ★ ★

THESE two added facilities will raise the capacity of the nation by 11.3% or 146,000,000 pounds, to a total of 1,434,230,000 pounds of aluminum ingot per annum.

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ORDERS for aluminum are such that the industry expects to operate at peak levels for at least the first half of 1950.

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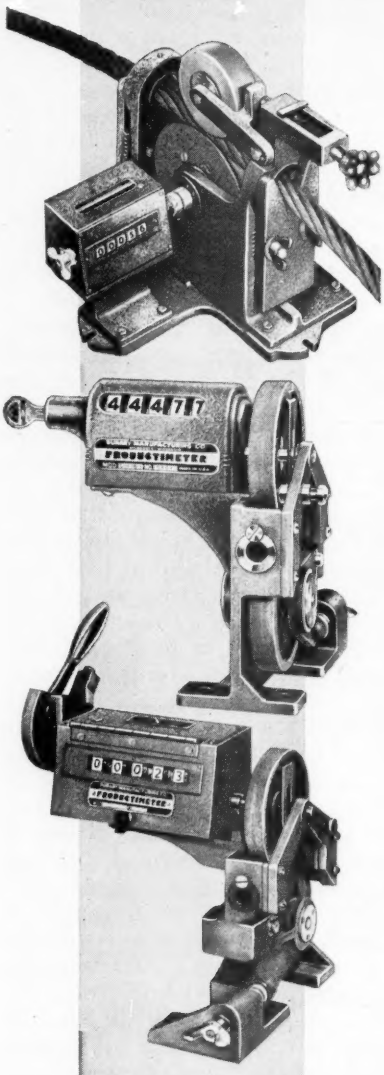

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An Investigation of the Weavability of Wire with Observations on the Defects of Wire and Wire Products, Part III

(*Continued from page 310*)

is considered, then the variation within the coil is greater than any heretofore found in good wire.

★ ★ ★

METALLOGRAPHIC specimens were made from the crimped wire and from the remnants of the crimp test specimens. Preliminary examination showed that these specimens were fully annealed and that there were no seams or cracks in the wire. At this point the cause of the trouble was not evident. However, hardness measurements on these same specimens confirmed the results of the transverse-crimp-sensitivity test, and the examination of these specimens was continued. In the absence of heat treatment variations, the hardness and stiffness variations became an indicator of chemical segregation in the wire. Segregation sometimes causes grain size differences in steel, and a grain size difference may cause a difference in hardness. In general, the finer the grain size the harder the steel.

★ ★ ★

IN order to show the grain size differences, the metallographic specimens were carefully repolished and etched. Photographs of these specimens appear as figures 37, 38 and 39. These photographs fairly well established the fact that the wire was badly segregated. As a further check upon this supposition, a chemical analysis was run on the wire. This analysis showed that the wire contained 0.20 percent nickel, 0.33 percent copper, and 0.05 percent chromium. Since these are extremely large amounts of tramp alloys to be present in any low carbon steel, and since nickel especially has a great tendency to segregate in steel, this chemical analysis clearly indicates that segregation caused the structural con-

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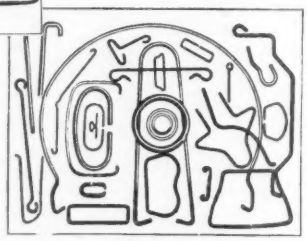

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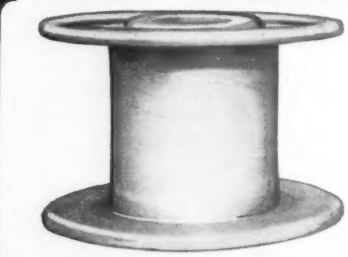

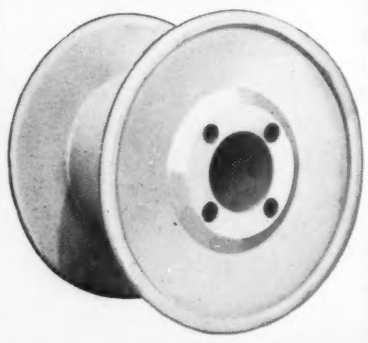

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dition shown in figures 37, 38, and 39. The segregation in this steel has been so severe as to result in non-uniform mechanical properties in the finished wire.

* * *

THE eighth case of unsatisfactory weaving wire consisted of three samples of 21 gage, American (2-4-48), Ludlow specifications, bright annealed wire. This wire caused trouble on one of the automatic, double-crimp type looms. All three samples were taken from one barrel of 21 gage wire, but the loom operator maintained that all the wire was not the same. Some of the coils had a dull luster, and the operator maintained that all of this "dark" wire caused trouble; it seemed to him to be "hard" and "soft" in spots. When this "dark" wire was used in the fill, the operator said that the loom had to be adjusted frequently and watched carefully to prevent "hickeys" from forming. A sample of "dark" wire was obtained from the operator for study. The rest of the wire had a bright luster and the operator maintained that some of this "white" wire was bad and some was good. The "bad white wire" seemed to be "hard" and "soft" over long lengths. When it was used in the fill, a soft length of wire would result in a high fill count for a time and then a length of hard wire would cause a low fill count for a time. Some of this type of wire was being woven at that particular time and a sample was obtained. The operator had saved a rather small sample of "good white wire" from a coil that had woven to his satisfaction. He maintained that it was "soft" and uniform. This sample was obtained from the operator for comparison with the other two samples.

* * *

EXAMINATION of this wire by means of the transverse-crimp-sensitivity test produced the following extraordinary results: The first four turns of wire from the coil of the "bad dark wire" gave an average crimp-sensitivity of 8.74 pounds. The next five turns from this coil gave an average ot 9.45 pounds. The tests did not in-

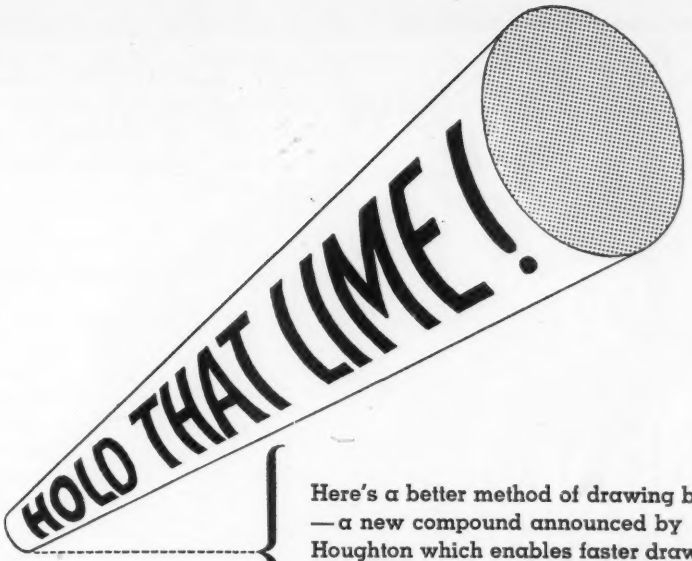
dicate any cyclic characteristic in this coil. The first two turns of wire from the coil of the "bad white wire" gave an average crimp-sensitivity of 8.51 pounds. The next five turns of wire from this coil gave an average of 9.27 pounds. The tests indicated the presence of a cyclic characteristic in this coil but the magnitude of this cyclic variation was minor compared to the difference between the above values. The first three turns of wire from the coil of "good white wire" gave an average crimp-sensitivity of 9.65 pounds. The next three turns gave an average crimp-sensitivity of 9.66 pounds. This coil also gave very minor indications of a cyclic characteristic in the coil.

★ ★ ★

METALLOGRAPHIC specimens were made up from the remnants of the crimp test specimens. The "softest" specimen from the "soft" section of each coil and the "hardest" specimen from the "hard" section of each coil was mounted in each case. Photographs of these specimens appear as figures 40, 41, 42, 43, 44, and 45. These photographs show that the wires are completely recrystallized even in the center, and that, therefore, the wires were probably properly annealed. As mentioned before, the differences in hardness may be the result of the differences in grain size; and, in the absence of heat treatment difficulties, the differences in grain size are probably the result of segregation. A chemical analysis on these wires showed that they all contained about 0.20 percent of nickel and 0.05 percent copper. This was considered to be sufficient confirmation of the fact that segregation caused the mechanical non-uniformity found in this wire.

★ ★ ★

IN each of these cases where segregation caused erratic variations in the stiffness of weaving wire, the wire contained 0.20 percent nickel and substantial amounts of other foreign elements. This is not conclusive evidence that these elements are the prime offenders, but in the absence of other evidence, it may be assumed that



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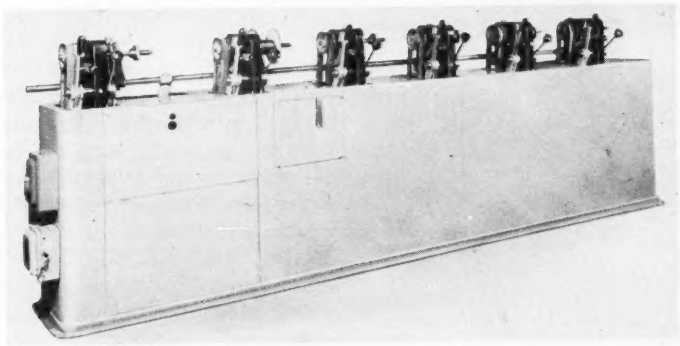

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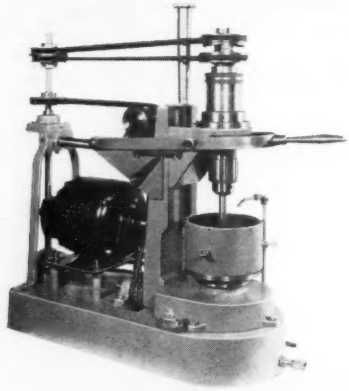

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nickel, at least, is one of the offending elements. Nickel is most certainly present in excessive amounts; analyses obtained by the author show that low carbon steel wire usually contains less than 0.05 percent nickel.

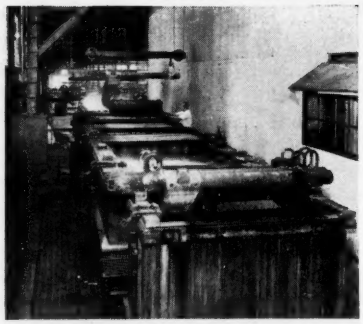
* * *

Weaving Wire Specifications

THE preceding discussion of defects of weaving wire has shown the necessity for obtaining wire that will weave satisfactorily. It may be that the manufacturers of weaving wire do not know that non-uniformly annealed or segregated wire will cause difficulties and losses in the wire weaving industry. In any event, the manufacturing specification is a list of instructions given to a manufacturer to tell him what his customer needs and how he should produce it. Any incompleteness in these instructions will usually eventually cause inefficiencies and losses. Every manufacturing specification should contain a description of the product, of the method of manufacture, of the quality of the product, and a description of how the product is to be inspected, marked, packaged, and shipped, [36].

* * *

THE few specifications for weaving wire that the author has seen contained the following items: the name or type of wire; the shape of the wire; its analysis; its tensile properties; the surface condition and color of the wire; its dimensional tolerance; and the size, cast, and marking of the spools or bundles. Instructions as to the method of manufacture and the inspection of weaving wire were omitted from those specifications for weaving wire. However, if perfect wire cloth is to be produced, then uniform weaving wire must be used; and instructions for the method of manufacture and for the testing of wire may have to be included in weaving wire specifications. A typical example of the need for more rigid manufacturing specifications for wire for the wire weaving industry is shown in figure 46. This wire has not been as thoroughly annealed as most wire, but it is uniform enough to be



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woven satisfactorily if it alone were used; and the cloth produced would be stiffer and stronger than cloth produced with more thoroughly annealed wire. This wire contains exactly the same type of steel as shown in figure 1, but this wire is 65 percent stiffer and harder than the wire of figure 1. This difference in the two wires probably was and certainly could be obtained merely by controlling the processing of the wire.

* * *

AT the present time Ludlow-Saylor Wire Company is receiving many different types of wire from as many different manufacturers. The following types include most of the important varieties of wire used by this company. The descriptive material and physical properties listed represent the best information the author has been able to obtain with regard to the specifications for these materials.

* * *

BAR stock, including rods and wire one-half inch in diameter and larger, is made of SAE 1045 steel. Bar stock is used to make heavy screens and grizzlies.

* * *

COMMON annealed wire is a blue-black annealed wire regularly used in sizes from 9 gage to 18 gage. The carbon content is usually 0.05 to 0.08 percent (0.10 max.); the manganese content is usually 0.20 to 0.30 percent (0.50 max.); and the phosphorus, silicon, and sulfur are usually less than 0.03 percent (0.05 max.). The tensile strength is 45-60,000 psi.; the yield point is 30-40,000 psi.; and the elongation is 20 to 30 percent. Common annealed wire is used where deep crimping is necessary, and where high hardness of the cloth is not necessary.

* * *

BRIGHT basic wire is a hard drawn wire used in sizes from 3/8 inch to 18 gage. The analysis is the same as that of common annealed wire. The tensile strength varies from 65-85,000 psi. for 1/4 inch wire, to 70-105,000 psi. for 4 to 10 gage wire, to 90-115,000 psi.

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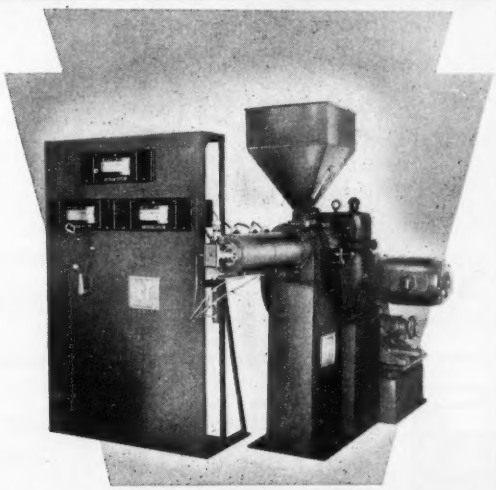

2" Davis-Standard Thermo-Plastic Extruding Machine

for 11 to 18 gage wire. Bright basic wire is used where very high hardness and spring action are not necessary. It is somewhat tougher than either common annealed wire or Superloy A.

* * *

AMERICAN bright basic is a hard drawn wire used regularly in sizes from 14 gage to 20 gage and sometimes in sizes down to 26 gage. The carbon content is 0.15 to 0.20 percent; the manganese content is 0.30 to 0.50 percent; and the phosphorus, silicon, and sulfur are a maximum of 0.05 percent. The tensile strength is 85-105,000 psi. American bright basic wire is used whenever bright basic wire fails to crimp to the degree required for a particular order.

* * *

SUPERLOY A is a hard drawn wire used in sizes from 3/8 inch to 20 gage. The carbon content is 0.55 to 0.65 percent; the manganese content is 0.75 to 1.05 percent; the phosphorus and sulfur are a maximum of 0.05 percent; and the silicon is 0.10 to 0.25 percent. The tensile strength is 160,000 psi. for 3/8 inch wire and increases nearly linearly with size to 215,000 psi. for 20 gage wire. Superloy A is a very stiff and hard wire; it will take only a shallow crimp and is used where hard, springy cloth is needed.

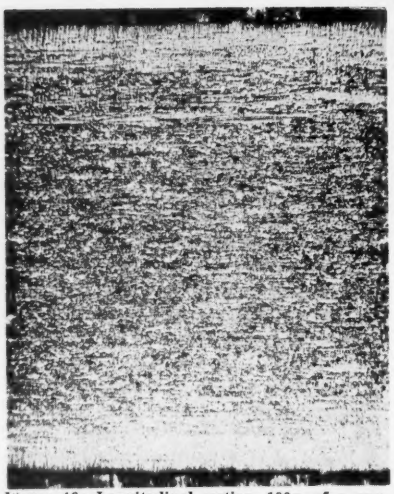

Figure 46: Longitudinal section, 100x, of a sample of 22 gage, American, low carbon, bright annealed weaving wire. This structure could be produced by a long anneal at a low annealing temperature. Nitol etch.

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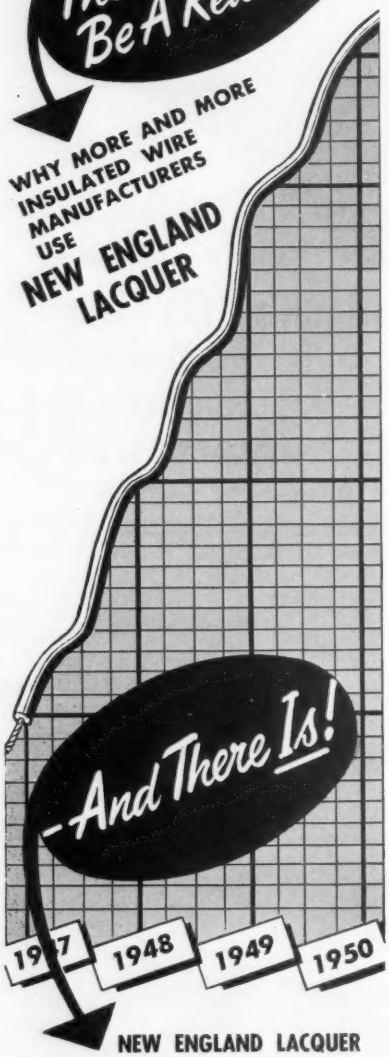

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SUPERLOY B is exactly like Superloy A except that its tensile strength is 152,000 psi. for 3/8 inch wire and 193,000 psi. for 20 gage wire. Superloy B will take a slightly deeper crimp than Superloy A.

* * *

LUDLOW specification weaving wire is a bright annealed wire used in all sizes smaller than 18 gage. This wire is given a "liquor finish." In sizes from 18 gage to 23 gage this wire usually has a carbon content of 0.05 to 0.08 percent (0.10 max.) and a tensile strength of 45-60,000 psi. Wire 24 gage and smaller has a carbon content of 0.10 to 0.20 percent and a tensile strength of 55-70,000 psi. The manganese content is 0.30 to 0.50 percent, and the phosphorus, silicon, and sulfur are usually less than 0.03 percent (0.05 max.). The yield point is 30-45,000 psi.; and the elongation is 20 to 30 percent. Ludlow specification wire is used as a general purpose wire in the weaving of fine steel cloth.

* * *

COPPER-FREE weaving wire is the same as Ludlow specification wire except that it is coated with pure tin, instead of a copper-tin alloy.

* * *

STAINLESS steel wire, types 304 and 316, contain 0.08 to 0.10 percent carbon; less than 0.04 percent phosphorus or sulfur; less than 2.00 percent manganese; and less than 1.00 percent silicon. Type 304 contains 18 to 20 percent chromium and 8 to 10 percent nickel; while type 316 contains 16 to 18 percent chromium and 10 to 14 percent nickel plus 1.75 to 2.50 percent molybdenum. Soft stainless steel should have a tensile strength of 90-100,000 psi., an elastic limit of 40-50,000 psi., and an elongation of over 35 percent. Quarter-hard stainless steel should have a tensile strength of 110,000 to 130,000 psi., and half-hard stainless steel should have a tensile strength of 130-150,000 psi. Stainless steel is used in all sizes smaller than 3/8 inch for cloth where corrosion resistance is desired. Its

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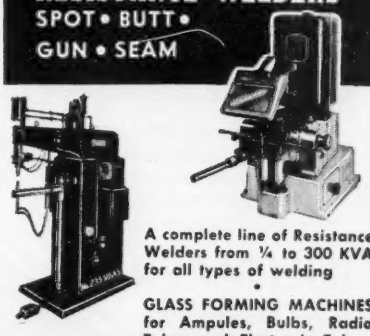

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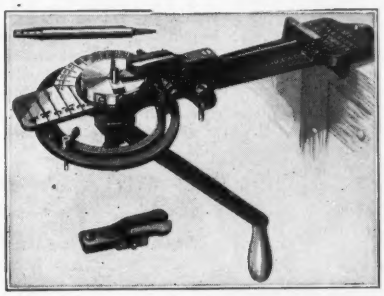

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most important use is in fine filter cloth.

* * *

MONEL wire is 70 percent nickel and 30 percent copper. Soft monel should have a tensile strength of 80-90,000 psi., an elastic limit of 40-50,000 psi., and an elongation of over 25 percent. Monel is used extensively for fine filter cloth.

* * *

BRASS wire is 70 to 80 percent copper and 30 to 20 percent zinc. It may have a tensile strength of 80-100,000 psi. Brass is used in the medium sizes (about 16 gage) for large opening cloth and in the fine sizes for special purpose filter cloth.

* * *

THE author has checked experimentally the data given for common annealed and Ludlow specification wire, but some of the other data must be considered to be roughly descriptive material which at best can be used only for tentative specifications. Further work may have to be done to verify or amend this data so that rigid specifications may be sent to the manufacturers of weaving wire. Once such specifications have been completed, then periodic acceptance tests should be run to make certain that the specifications are adhered to.

* * *

Part IV will be published in the May 1950 issue of Wire and Wire Products.

The References and Acknowledgments will be published with Part IV of this article.

The Anti-Corrosive Power of Paints Determined by Measurement of Electrode Potentials

THE electrode potential of cells: iron/"normal" sea water and painted iron/"normal" sea water were measured against a normal calomel electrode. A comparison was made of the electrode potentials of iron covered with various

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paints prepared with "linseed oil." The authors measured the change in potential produced when the painted iron in contact with sea water was scratched; some iron is then in contact with sea water. A comparison of the data obtained under the three conditions permits classification of each of the paints from the point of view of "mechanical protection" and of "active protection." This method with check results will be used to study systematically anti-corrosive submarine paints. A microscopic examination of the steel specimens was made and this data compared with the electro-chemical results.

★ ★ ★

REPRINTED from paper by E. Jimeno, S. Medina-Castellanos and J. Aravio-Torre published by The Institute Espanol de Oceanografia, Madrid, Spain.

★ ★ ★

Kaiser Making Plastic Covered Line Wire

PRODUCTION of polyethylene-covered aluminum line wire, a completely new electrical conductor possessing marked advantages where weatherproof or covered wire is desired, has been announced by **Kaiser Aluminum & Chemical Sales, Inc.**

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THIS type of covered wire offers advantages over the conventional textile coverings in that it is a smooth, clean, non-sticky plastic material, black in color, with superior resistance to moisture, sunlight, weather hazards and abrasion. Although polyethylene itself is more costly than other covering materials, its use in combination with aluminum conductor gives a product with high serviceability.

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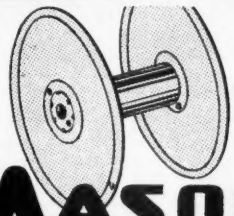

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June 16th—West Coast Regional Meeting, Sir Francis Drake Hotel, San Francisco, Cal.

Oct. 23-26, Incl.—Annual Convention of Wire Association, Lord Baltimore Hotel, Baltimore, Md.

RICHARD E. BROWN, Executive Secretary
300 Main Street Stamford, Conn.

Handling Materials in Whitney Blake's Plant

(*Continued from page* 312)

FINISHED wire, in coils, and on reels, is moved into the Shipping Department on pallets. Eighteen small-sized reels are made into a single load, while coils of wire are moved on pallets some 50 at a time.

* * *

OUT-BOUND product, which has been placed in small cartons, is palletized in unit loads of from 90 to 100 in the Packing Department and then moved to the Shipping Department where it is placed in racks. These racks accommodate three pallets vertically. They are placed back-to-back between aisles, permitting instant requisition to make up shipments. Work of inventory also has been simplified through use of the racks of pallets, and also through palletization of raw, or goods-in-process, stores.

Finished coils of wire in palletized loads are stacked in the Shipping Department at the plant. Load pictured is about to be deposited by battery-powered fork truck atop a palletized load of nine reels of finished wire. In background may be seen storage racks, each compartment of which contains a palletized unit load of 100 cartons of finished product awaiting outward shipment. Note height to which loads may be placed in racks. Use of fork truck-pallet system of handling and storing material at the Whitney Blake plant has made hitherto wasted vertical storage area fully available; has conserved man-power and time. Firm, which manufactures drop wire, portable cords, and shielded cable for electronic devices, has made use of fork truck-pallet system since 1944. * * * * * *

* * *

ALL incoming goods are received at one end of the plant, where they are stored. They are moved in straight-line production flow to the other end of the plant where the Shipping Department is located. This prevents congestion of traffic flow, and permits the use of broad aisles. Bays off the main traffic aisles are used as temporary, or hold-storage, areas, for work-in-process, or of supplies that

are in constant demand and which, therefore, must be immediately available.

* * *

Workable Merit Rating Systems

CRITICS of merit rating as a management tool offer almost the identical arguments as do the opponents of statistics, states the Labor Relations Institute, New York, in a report to members. Both express doubts as to their reliability and their validity.

* * *

THE thing to do, therefore, continues the LRI report, is to: a) Improve the reliability of our rating habits and methods. That is, we must make sure we are actually measuring the factor we intended to measure; and b) we must try to improve the validity of our ratings. That is, we must come as close to the exact measurements of a factor as we possibly can.

* * *

"TO begin with," the Institute report points out, "merit rating systems must always be closely patterned to the individual operating needs and working habits of each company. Canned, or ready-made systems should be avoided like poison."

* * *

FOR a free copy of the complete article on workable merit rating systems, write to the Labor Relations Institute, 1776 Broadway, New York 19, New York.

* * *

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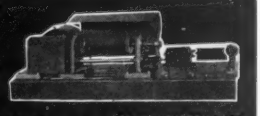
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Safety in the Mill

(*Continued from page* 311)

IN 1938 the Safety Inspector together with two members of the Committee inaugurated weekly plant inspection tours. The purpose of the tours is to uncover safety hazards and check on plant housekeeping. We were now in accord with the principle that a clean work place was a safe work place. When the inspection party enters a department they immediately pick up the foreman in charge who accompanies them until they leave his department. By this means the foreman knows first-hand the criticisms and suggestions of the Committee.

★ ★ ★

DURING the prewar years of 1939, 1940 and 1941, we conducted many safety contests with good results. Most of these were based on man hours worked without a lost time accident and usually resulted in the employees with the best records receiving some sort of recognition. For example the reward at the end of one contest was the presentation of a pair of safety shoes to each employee in departments not having had a lost time accident. In addition, employees in each accident-free department were eligible to participate in a drawing held monthly at which time fifteen cards were drawn, each card being worth a pair of safety shoes.

★ ★ ★

IN 1941 we had a large sign erected at the entrance to the Main Gate of our Plant No. 1. On this sign we displayed the number of days that the whole plant had worked without a lost time accident. During the war with a large increase in employment (at one time we had a total of 2000 employees including 500 women) we reached our highest total of 265 days without a disabling injury. This sign attracted more than Company-wide interest. It was watched closely by motorists who passed it daily. The sign still stands and is changed every morning. Unfortunately we have never been able to equal that wartime record.

★ ★ ★

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WITH the coming of the war we faced another real job of safety education. Due to lack of manpower available, we were forced to hire and train 500 female employees. Heretofore we had had a normal complement of about 15 women. Jobs that had previously been done only by men had to be taken over by females. The result was almost a foregone conclusion. After reducing our accident frequency rate to about 10 just prior to 1941, it jumped to 17.9 for 1942 and levelled off to around 15 for 1943, 1944 and 1945.

* * *

BY 1946 we were getting back to normal and again found ourselves with less than 25 female employees. Past training began to be evident immediately. The frequency rate for 1946 dropped to 13.4 and in 1947 it fell to 8.5. For the past two years, 1948 and 1949, our frequency rate seems to have levelled off at 7.6 and 8.1 respectively. We are by no means resting on our oars, neither do we think we have accomplished anything spectacular. After all, 14 employees did lose 422 days of work due to plant injuries in the year just past.

* * *

IN conclusion, let me say that the battle against accidents will never be won until some means or method is devised to instill "safety consciousness" into every worker so that the feeling of doing a job safely will become just as important to him as doing it quickly and well.

* * *

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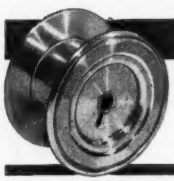
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Norton Co., Worcester, Mass.

ACID INHIBITORS—
(See Inhibitors, Pickling)

ACID-PROOF CONSTRUCTION—
Haveg Corporation, Newark, Del.

ANNEALING MACHINES—Open Flame
Syncro Machine Co., Perth Amboy, N. J.

ANNEALING POTS AND BOXES—
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.

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Sleeper & Hartley, Inc, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machy., Inc., Pawtucket, R. I.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Morgan Construction Co., Worcester, Mass.
Ross, J. O., Engr. Corp., New York, N. Y.

BAR STOCK—Stainless Steel
American Steel & Wire Company, Cleveland, Chicago, New York.
Columbia Steel Co., San Francisco, Calif.
U. S. Steel Export Company, New York, N. Y.

BASKETS—Pickling
Rolock, Inc., Fairfield, Conn.

BOBBINS—Braider & Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

BORAX—Wire Drawing
Pacific Coast Borax Corp., New York, N. Y.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRAKES—Pneumatic
Entwistle, Jas. L. Co., Pawtucket, R. I.

CABLE—Aluminum
Aluminum Co. of America, Pittsburgh, Pa.

CABLE LACQUERING OVENS—
Industrial Ovens, Inc., Cleveland, O.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

CASTINGS—Wire Mill
Scudder, E. J., Fdry. & Mach. Co., Trenton, N.J.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
(See Cleaners—Metal)

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Houghton, E. F., & Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Metal & Thermit Corp., New York, N. Y.
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Standard Industrial Compounds Co., Inc., Chicago, Ill.

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Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, O.
Haveg Corp., Newark, Del.
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Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

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Roebling's, John A. Sons, Co., Trenton, N. J.
Wickwire Bros., Cortland, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.

COATING COMPOUNDS—
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Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Inc., Chicago, Ill.

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Morgan Construction Co., Worcester, Mass.
Ruesch, H. J. Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

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Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Diamond
Eastern Carbide Corp., New Rochelle, N. Y.
Hyprez Division, Engis Equipment Co., Chicago, Ill.
Magnus Chemical Co., Garwood, N. J.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Metal & Thermit Corp., New York, N. Y.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
American Lanolin Corp., Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Houghton, E. F. & Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Inc., Chicago, Ill.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Houghton, E. F. & Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Pacific Coast Borax Corp., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Inc., Chicago, Ill.
Swift & Company, Chicago, Ill.

CONDUCTORS—Flexible, Electrical
Montgomery Co., The, Windsor Locks, Conn.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

CORROSION PREVENTIVES—
Angier Corporation, The, Framingham, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Adamas, Carbide Corporation, Harrison, N. J.
Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Metal Carbides Corporation, Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Champion Diamond Co., New York, N. Y.
Diamond Distributors, Inc., New York, N. Y.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
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Hyprez Division, Engis Equipment Co., Chicago, Ill.
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Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Carbide
(See Dies—Tungsten Carbide)

DIES—Cold Heading
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Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Indiana Wire Die Co., Ft. Wayne, Ind.
Metal Carbides Corporation, Youngstown, Ohio.
Vascoloy-Ramet Corp., No. Chicago, Ill.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., New York, N. Y.
Champion Diamond Co., New York, N. Y.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
North American Philips Co. Inc., New York, N. Y.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Extrusion
Adamas, Carbide Corporation, Harrison, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth Sterling Steel & Carbide Corp., McKeesport, Pa.
Hartley Tool & Die Co., Thomaston, Conn.
Metal Carbides Corporation, Youngstown, Ohio.
Robertson, John, Co., Brooklyn, N. Y.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Eyelet
Hartley Tool & Die Co., Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
Adamas, Carbide Corporation, Harrison, N. J.
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., New York, N. Y.
Carboloy Co., Detroit, Mich.
Champion Diamond Co., New York, N. Y.
Cochaud Wire Die Corp., New York, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hartley Tool & Die Co., Thomaston, Conn.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio.
New England Wire Die Co., Worcester, Mass.
North American Philips Co., Inc., New York, N. Y
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

DIES—Special Shapes, Etc.
Adamas, Carbide Corporation, Harrison, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Hartley Tool & Die Co., Thomaston, Conn.
Indiana Wire Die Co., Ft. Wayne, Ind.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.

DIES—Swaging
Fenn Manufacturing Co., Hartford, Conn.
Sjogren Tool & Machine Co., Inc., Auburn, Mass.

DIES—Tantalum Carbide
Adamas, Carbide Corporation, Harrison, N. J.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corporation, Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

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DIES—Tube Drawing
Adamas, Carbide Corporation, Harrison, N. J.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Hartley Tool & Die Co., Thomaston, Conn.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.

DIES—Tungsten Carbide
Adamas, Carbide Corporation, Harrison, N. J.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Hartley Tool & Die. Co., Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Wayne Wire Die Co., Hillside, N. J.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRUMS—Flange Steel
Hubbard Spool Company, Chicago, Ill.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., The, Paterson, N. J.

DRYING EQUIPMENT—
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Industrial Ovens, Inc., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

ENGINEERS—Consulting
Wire Mill—Fisher, Edward J. P., North Jackson, Ohio
Lewis, Kenneth B., Worcester, Mass.
Galvanizing—Imhoff, Wallace G. Co., The, Los Angeles, Calif.
Spring Design—Carlson Co., The, New York, N. Y.
Wire Cloth—Wickwire, T. H., Jr., Philadelphia, Pa.
Metal Fatigue—Fatigue of Materials Laboratory, Princeton, N. J.

EQUIPMENT—Insulation Testing
Davis, R. L., Elec. Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FENCING & FENCES—Wire
Interlocking Fence Co., Morton, Ill.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin Chemical Company, The, Pittsburgh, Pa.

FRICTION PAY-OFF STANDS—
Industrial Ovens, Inc., Cleveland, Ohio.

FURNACES—Annealing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Holden, A. F., Co., The, New Haven, Conn. and Detroit, Mich.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio.
Rockwell, W. S., Co., Fairfield, Conn.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Michigan Oven Co., Detroit, Mich.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

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Harper Electric Furnace Corp., Niagara Falls, N. Y.
Rockwell, W. S., Co., Fairfield, Conn.
Trauwood Engineering Co., The, Cleveland, Ohio.

FURNACES—Galvanizing Equipment
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, New Haven, Conn, and Detroit, Mich.
Rockwell, W. S. Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Hard'ing & Temp'ing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Holden, A. F., Co., The, New Haven, Conn, and Detroit, Mich.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio.
Robertson, John, Co., Brooklyn, N. Y.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, New Haven, Conn, and Detroit, Mich.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Holden, A. F., Co., The, New Haven, Conn, and Detroit, Mich.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Pot (oil, gas, electric)
Ajax Electric Co., Inc., Philadelphia, Pa.
Holden, A. F., Co., The, New Haven, Conn, and Detroit, Mich.

FURNACES—Resistance Heating, Strand
Trauwood Engineering Co., The, Cleveland, Ohio.

FURNACES—Salt Bath
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Holden, A. F., Co., The, New Haven, Conn, and Detroit, Mich.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Harper Electric Furnace Corp., Niagara Falls, N. Y.
Michigan Oven Co., Detroit, Mich.
Rockwell, W. S., Co., Fairfield, Conn.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING EQUIPMENT—
Steel Equipment Co., Cleveland, Ohio.
Wean Equipment Corp., Cleveland, Ohio.

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Auburn, Mass.

HOOKS—Pickling & Liming
Rolock, Inc., Fairfield, Conn.
Youngstown Welding & Engineering Co., Youngstown, Ohio.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Rolock, Inc., Fairfield, Conn.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin Chemical Company, The, Pittsburgh, Pa.

INSULATING LACQUERING SYSTEMS—Continuous
American Insulating Machine Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.

INSULATING MATERIALS—
Belding, Heminway, Corticelli Co., New York, N. Y.
New England Lacquer Co., E. Providence, R. I.
Owens Corning Fiberglas Corp., Toledo, O.
Standard Varnish Works, Staten Island, N. Y.
Twitchell, E. W., Philadelphia, Pa.

INSULATING MATERIALS—Paper — For Electric Wire Cable.
Twitchell, E. W., Philadelphia, Pa.

LACQUERS—For Electric Wire
New England Lacquer Co., E. Providence, R. I.
Standard Varnish Works, Staten Island, N. Y.

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Roos, Tool & Mfg. Co., Montclair, N. J.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LININGS—Acid and Alkali Proof
Haveg Corp., Newark, Del.

LOOMS—Weaving Wire Cloth
Bruckner-Mitchell, Inc., New York, N. Y.

LUBRICANTS — For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Inc., Chicago, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

LUMBER—Wire Mill, for lagging and car blocking
North Anson Reel Co., North Anson, Maine.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Barbed Wire
Glader Machine Works, Chicago, Ill.
Wean Engineering Co., Cleveland, Ohio.

MACHINERY—Bead Wrapping
Terkelsen Machine Co., Boston, Mass.

MACHINERY—Braiding
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Brazing
Eisler Engineering Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bunching
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Bundling, Scrap
Fenn Manufacturing Co., Hartford, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H. Machine Co., The, Bridgeport, Conn.

MACHINERY—Cable, Rope Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

WHERE TO BUY, Continued

MACHINERY—Coilers
Boyd & Sons Manufacturing Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Fenn Manufacturing Co., Hartford, Conn.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (used), New York, N. Y.
New England Butt Co., Providence, R. I.
Ruesch, H. J. Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.
Wire & Textile Machinery, Inc., Pawtucket, R. I.

MACHINERY—Cold Heading
(See Cold Headers)

MACHINERY—Copper Wire Drawing and Rolling
Aetna-Standard Engineering Co., Youngstown, Ohio.
American Insulating Mach'y Co., Phila., Pa.
Fenn Manufacturing Co., Hartford, Conn.
National Mach'y Exch. (Used), New York, N. Y.
Ruesch, H. J. Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Mach'y Co., Phila., Pa.
National Erie Corp., Erie, Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cutting
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio.
Mettler Machine Tool, Inc., New Haven, Conn.
National Mach'y Exch. (Used) New York, N. Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Die Making
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel & Carbide Corp., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Roos, Tool & Mfg. Co., Montclair, N. J.
Wayne Wire Die Co., Hillside, N. J.
Wickman, A. C., Ltd., Coventry, England.

MACHINERY—Draw Benches
Aetna-Standard Engineering Co., Youngstown, Ohio.
Fenn Manufacturing Co., Hartford, Conn.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Edging
Fenn Manufacturing Co., Hartford, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.
Michigan Oven Co., Detroit, Mich.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Extruding
National Erie Co., Erie, Pa.
National Rubber Machinery Co., Akron, Ohio.
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Interlocking Fence Co., Morton, Ill.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Fenn Manufacturing Co., Hartford, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Galvanizing
(See Galvanizing Equipment)

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Pawtucket, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
National Erie Co., Erie, Pa.
National Rubber Machinery Co., Akron, Ohio.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
Interlocking Fence Co., Morton, Ill.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
Fenn Manufacturing Co., Hartford, Conn.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Material Handling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Pawtucket, R. I.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Pickling
Rolock, Inc., Fairfield, Conn.

MACHINERY—Pointing
Aetna-Standard Engineering Co., Youngstown, Ohio.
Fenn Manufacturing Co., Hartford, Conn.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Poultry Wire Fencing
Interlocking Fence Co., Morton, Ill.

MACHINERY—Rod Mill
Fenn Manufacturing Co., Hartford, Conn.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rolling Mill
Fenn Manufacturing Co., Hartford, Conn.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rubber Insulating
Royle, John & Sons, Paterson, N. J.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Mystic, Conn.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Screw Wire
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Davis, R. L. Electric Co., Wallingford, Conn.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Fenn Manufacturing Co., Hartford, Conn.
New England Butt Co., Providence, R. I.
Ruesch, H. J. Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Mystic, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Boyd & Sons Manufacturing Co., Phila., Pa
Bruckner-Mitchell, Inc., New York, N. Y.
Davis, R. L. Electric Co., Wallingford, Conn.
Eisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
National Mach'y Exch. (Used), New York, N.Y.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Lewis Machine Co., The, Cleveland, Ohio.
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N.Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Stranding
Hughesville Machine & Tool Co., Hughesville, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Forming
Wickman, A. C., Ltd., Coventry, England.

MACHINERY—Strip Steel
Aetna-Standard Engineering Co., Youngstown, Ohio.
Fenn Manufacturing Co., Hartford, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Steel Equipment Co., Cleveland, Ohio.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Swaging
Fenn Manufacturing Co., Hartford, Conn.
National Erie Corp., Erie, Pa.
National Mach'y Exch. (Used), New York, N.Y
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

WHERE TO BUY, Continued

MACHINERY—Testing Physical
Scott Testers, Inc., Providence, R. I.

MACHINERY—Testing Equipment—Sparkers
Davis, R. L. Elec. Co., Wallingford, Conn.
Entwistle, Jas. L., Pawtucket, R. I.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.
Wean Equipment Co., Cleveland, Ohio.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Fenn Manufacturing Co., Hartford, Conn.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Marshall-Richards Machine Company, Ltd., Trenton, N. J.

MACHINERY—Weaving Wire Cloth
Bruckner-Mitchell, Inc., New York, N. Y.

MACHINERY—Welding Wire
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Bruckner-Mitchell, Inc., New York, N. Y.
Davis, R. L. Electric Co., Wallingford, Conn.
Eisler Engineering Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wind-up (Constant Tension, Variable Speed)
Aetna-Standard Engineering Co., Youngstown, Ohio.
Davis, R. L. Electric Co., Wallingford, Conn.
Fenn Manufacturing Co., Hartford, Conn.
Industrial Ovens, Inc., Cleveland, Ohio.
Marshall-Richards Machine Company, Ltd., Trenton, N. J.
Standard Machinery Co., Mystic, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
Kilmer, M. D., & Co., Cleveland, Ohio.

MACHINERY—Wire Drawing
Aetna-Standard Engineering Co., Youngstown, Ohio.
American Insulating Mach'y Co., Phila., Pa.
Fenn Manufacturing Co., Hartford, Conn.
Marshall-Richards Machine Company, Ltd., Trenton, N. J.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Svenska Telegrambyran (Morgardshammer) Stockholm, Sweden
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Wire Forming
Fenn Manufacturing Co., Hartford, Conn.
Kilmer, M. D. & Co., Cleveland, Ohio.
National Mach'y Exch. (Used), New York, N.Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Wickman, A. C., Ltd., Coventry, England.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wood Screw
National Mach'y Exch. (Used), New York, N.Y.

MACHINERY—Wrapping Straight Lengths and Tubing
Angier Corporation, The, Framingham, Mass.
Terkelsen Machine Co., Boston, Mass.

MACHINERY—Wrapping Wire Coils
Angier Corporation, The, Framingham, Mass.
Terkelsen Machine Co., Boston, Mass.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem, Rolling & Edging
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Co., Cleveland, Ohio.

NAILS—Wire
American Steel & Wire Co., Cleveland, Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling, John A. Sons Co., Trenton, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.
Michigan Oven Co., Detroit, Mich.

OVENS—Dehydrogenizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Industrial Ovens, Inc., Cleveland, Ohio.
Michigan Oven Co., Detroit, Mich.
Ross, J. O., Engr. Corp., New York, N. Y.

OVENS—Rod Bakers
Michigan Oven Co., Detroit, Mich.

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Industrial Ovens, Inc., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Angier Corporation, The, Framingham, Mass.
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.
Terkelsen Machine Co., Boston, Mass.

PAPER—For Coil Wrapping and Corrosion Prevention
Angier Corporation, The, Framingham, Mass.
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.
Terkelsen Machine Co., Boston, Mass.

PATENT ATTORNEYS—
Lancaster, Allwine & Rommel, Washington, D.C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin Chemical Co., The, Pittsburgh, Pa.

PICKLING—Hooks, etc. Acid Resisting
Rolock, Inc., Fairfield, Conn.
Youngstown Welding & Engineering Co., Youngstown, Ohio.

PICKLING TANK LININGS—
Haveg Corp., Newark, Del.

PLASTIC TESTERS—
Scott Testers, Inc., Providence, R. I.

PNEUMATIC CYLINDERS—
Entwistle, James L. Co., Pawtucket, R. I.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio.

POTS—Lead Melting
Robertson, John, Co., Brooklyn, N. Y.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Mystic, Conn.

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry & Mach. Co., Trenton, N.J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

REEL AND TENSION STANDS—
Davis, R. L. Electric Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.
Industrial Ovens, Inc., Cleveland, Ohio.
Roll-a-Reel, Cincinnati, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Roll-a-Reel, Cincinnati, Ohio
Watson Machine Co., Paterson, N. J.

REELS & SPOOLS—Drawn Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Co., Chicago, Ill.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
American Pulley Company, Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp. Niles, Ohio.

REELS & SPOOLS—Collapsible
Entwistle, Jas. L. Co., Pawtucket, R. I.

REELS & SPOOLS—Plastic
Hubbard Spool Co., Chicago, Ill.

REELS & SPOOLS—Steel
American Pulley Company, Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mason Can Company, Providence, R. I.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS AND SPOOLS—Shipping and Shop
Acrometal Products, Inc., Minneapolis, Minn.
American Pulley Company, Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Clark, J. L., Mfg., Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mason Can Company, Providence, R. I.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.
North Anson Reel Co., North Anson, Maine.

REELS & SPOOLS—Wooden
Acrometal Products, Inc., Minneapolis, Minn.
American Woodworking Co., Chicago, Ill.
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Durkee Mfg. Co., Pine River, Minn.
North Anson Reel Co., North Anson, Maine.

REELS—Metal Bound
Durkee Mfg. Co., Pine River, Minn.
Hubbard Spool Co., Chicago, Ill.
North Anson Reel Co., North Anson, Maine.

REELS—Takeoff
Acrometal Products, Inc., Minneapolis, Minn.
American Pulley Company, Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Clark, J. L. Mfg. Co., Rockford, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.
North Anson Reel Co., North Anson, Maine.

REELS—Vulcanizing & Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Wire Drawing
Acrometal Products, Inc., Minneapolis, Minn.
American Pulley Company, Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

WHERE TO BUY, Continued

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
American Pulley Company, Philadelphia, Pa.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg., Co., The, Hazardville, Conn.
Durkee Mfg. Co., Pine River, Minn.
Hubbard Spool Company, Chicago, Ill.
Mason Can Company, Providence, R. I.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.
North Anson Reel Co., North Anson, Maine.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

RESISTANCE HEATING—Annealing Patenting, Etc.
Trauwood Engr. Co., Cleveland, Ohio.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Drying Systems, Inc., Chicago, Ill.
Rockwell W. S., Co., Fairfield, Conn.
Ross, J. O., Engineering Corp., New York, N.Y.

RODS—Aluminum
Aluminum Co. of America, Pittsburgh, Pa.

RODS—Nickel Alloy
International Nickel Co., Inc., New York, N.Y.

RODS—Stainless Steel
American Steel & Wire Co., Cleveland, Ohio.

RODS—Wire—Non-Ferrous
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
American Steel & Wire Company, Cleveland, Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Roebling's John A., Sons Co., Trenton, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott Testers, Inc., Providence, R. I.

RUST PROOF COMPOUNDS—
(See Compounds—Rust Preventing)

RUST REMOVING COMPOUNDS—
(See Compounds—Rust Preventing)

SALTS—Heat Treating, Descaling, etc.
Holden, A. F., Company, The, New Haven, Conn. and Detroit, Mich.

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc., Pawtucket, R. I.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Potter, Neil Co., Newark, N. J.
Standard Industrial Compounds Co., Inc., Chicago, Ill.
Swift & Company, Chicago, Ill.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Ovens, Inc., Cleveland, Ohio.

STAMPINGS—Steel
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Steel
Armco Steel Corp., The, Middletown, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Roebling's, John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., Paterson, N. J.

TANKS—Compound
Haveg Corp., Newark, Del.
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Haveg Corp., Newark, Del.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.

TINSEL—Cords, Decorative
(See: Tinsel—Electric Conductor)

TINSEL—Electric Conductor
Montgomery Co., The, Windsor Locks, Conn.

TINSEL—Electric Resistance
(See: Tinsel—Electric Conductor)

TINSEL—Lame, Silver and False Gold
(See: Tinsel—Electric Conductor)

TINSEL—Thread, Silver and False Gold
(See: Tinsel—Electric Conductor)

TINSEL—Thread, Decorative
(See: Tinsel—Electric Conductor)

TINSEL—Wire
(See: Tinsel—Electric Conductor)

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRAVERSES—For Reels
Entwistle, James L. Co., Pawtucket, R. I.
Hubbard Spool Company, Chicago, Ill.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
Fenn Manufacturing Company, Hartford, Conn.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y Inc., Pawtucket, R. I.

TUBE BENDERS AND FORMERS—
H. D. Kilmer Co., Cleveland, Ohio.
Ruesch, H. J., Machine Co., Newark, N. J.

TURKS HEADS—
Fenn Manufacturing Co., Hartford, Conn.

VALVES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VARNISHES—For Insulation
Standard Varnish Works, Staten Island, N. Y.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WEAVING—Industrial Wire Cloth
Bruckner-Mitchell, Inc., New York, N. Y.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.

WIND-UP AND UNWIND SYSTEMS—Continuous
American Insulating Mach'y Co., Phila., Pa.
Davis R. L. Electric Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

WIRE—Aluminum
Aluminum Co. of America, Pittsburgh, Pa.
Malin & Co., Cleveland, Ohio.

WIRE—Barbed
Interlocking Fence Co., Morton, Ill.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
American Steel & Wire Co., Cleveland-Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Timmerbiel, E., Greenwich, Conn.
U. S. Steel Export Co., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Electric
Malin & Co., Cleveland, Ohio.

WIRE—Flat, Fine
Montgomery Co., The, Windsor Locks, Conn.

WIRE—Manufacturers
American Steel & Wire Co., Cleveland-Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Timmerbiel, E., Greenwich, Conn.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Molybdenum
North American Philips Co., Inc., New York, N. Y.

WIRE—Music
American Steel & Wire Co., Cleveland-Chicago, New York.
Columbia Steel Co., San Francisco, Calif.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., Cleveland, Ohio.
Timmerbiel, E., Greenwich, Conn.
U. S. Steel Export Co., New York, N. Y.

WIRE—Nickel & Nickel Alloy
International Nickel Co., Inc., New York, N. Y.

WIRE—Nickel Silver and Phosphor Bronze
Malin & Co., Cleveland, Ohio.

WIRE—Spring
American Steel & Wire Co., Cleveland-Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Timmerbiel, E., Greenwich, Conn.
U. S. Steel Export Co., New York, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
American Steel & Wire Co., Cleveland-Chicago, New York.
Columbia Steel Co., San Francisco, Calif.
Firth Sterling Steel & Carbide Co., McKeesport, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
U. S. Steel Export Co., New York, N. Y.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Timmerbiel, E., Greenwich, Conn.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting
Pittsburgh Cut Wire Co., Pittsburgh, Pa.
Wickwire Brothers, Inc., Cortland, N. Y.

WIRE—Tungsten
North American Philips Co., Inc., New York, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE CLOTH—Industrial
Roebling's, John A., Sons Co., Trenton, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.

WRAPPING PAPER—Creped
Angier Corporation, The, Framingham, Mass.
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.

YARNS & TAPES—
Belding, Heminway, Corticelli Co., New York, N. Y.
Owens Corning Fiberglas Corp., Toledo, Ohio.
Twitchell, E. W., Philadelphia, Pa.

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON 3, NEW JERSEY, U. S. A.

WATSON

ELECTRICAL WIRE AND CABLE, WIRE ROPE AND CORDAGE MACHINERY

TIRE CORD STRANDERS - TYPE "TH1"

PATENTS GRANTED AND PATENTS PENDING

OUR RECENTLY RELEASED SEMI-AUTOMATIC DESIGN EMBODIES NEW PRINCIPLES, HAS BEEN PRODUCTION-TESTED AND MULTIPLES ARE IN SUCCESSFUL OPERATION.

NEW ROTOR CONSTRUCTION FOR SAFE OPERATING SPEED OF 6000 R.P.M.

SELF-LOCKING SHAFTLESS SPOOL BOATS.

ALL ELECTRICALS BUILT-IN AND WIRED FOR OPERATION.

AUTOMATIC RUN-OUT, WIRE-BREAK AND SAFETY STOPS.

SIGNAL LIGHTS AND PRE-SET MEASURING STOPS.

4-SECOND BRAKES AND CLOSE-COUPLED AUXILIARIES FOR UTMOST OPERATORS - CONVENIENCE.

REFINEMENTS AND FEATURES TOO NUMEROUS FOR PUBLICATION HERE, COMBINE TO MAKE THIS THE MOST OUTSTANDING SMALL STRANDER EVER OFFERED.

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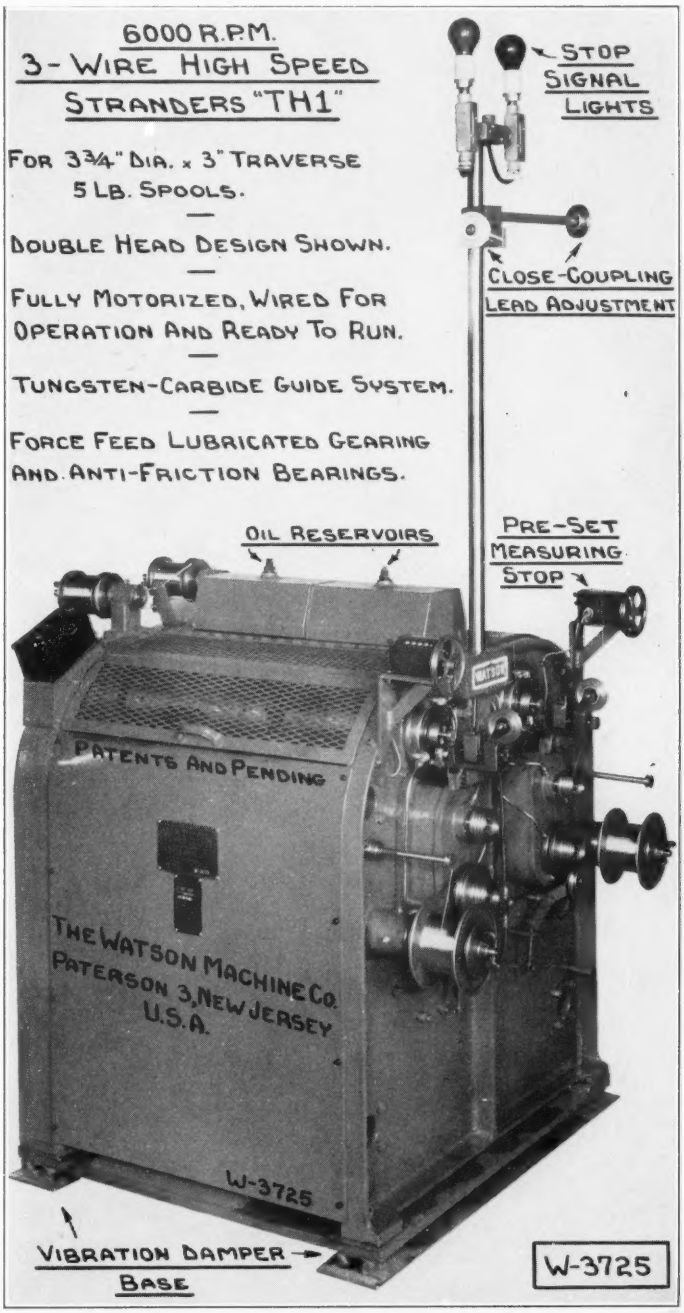
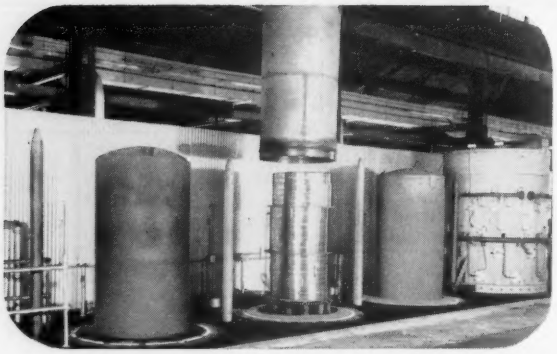


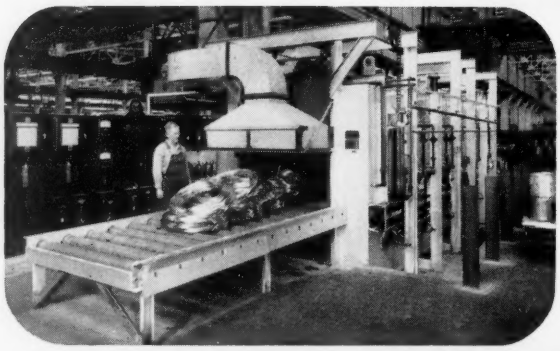


EF gas fired and electric hood, pit and other batch and continuous type furnaces are available for normalizing rod, annealing wire, strip and other processes.

Clean annealing nickel-silver and other alloy wire in an EF gas fired radiant tube continuous roller hearth furnace. Handles coils up to 30" in diameter.

some typical EF installations

These combination electric and gas fired radiant tube bulkhead tray type furnaces are used extensively for bright annealing wire on reels and in coils.



An EF gas-fired three-chamber roller hearth with forced circulating system providing accurate temperature distribution, uniform finish and anneal — continuously.

engineered for efficiency and built to last

● We have made outstanding production installations for normalizing rod and bright annealing wire in coils, strands, on reels and spools; both ferrous and non-ferrous, including stainless — for heat treating bolts, springs and other wire products — for heating billets, wire bars and other heating and heat treating processes. We solicit *your* furnace inquiries.

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GAS FIRED, OIL FIRED AND ELECTRIC FURNACES
FOR ANY PROCESS, PRODUCT OR PRODUCTION

Salem - Ohio